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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 23 — NEW YORK AND LONDON — NUMBER 29

Published at 218 William St., New York,
Every Thursday by the

American Machinist Press.

[INCORPORATED.]

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A. LEIGHTON DONNELL, Sec'y.

Also published at 34 Norfolk St., Strand, London, W. C.,
Every Saturday.

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Correspondence on mechanical subjects solicited. Name and address must always be given—not necessarily for publication.

Address all business communications to the American Machinist Press. Matter for reading columns may be addressed to the Editor.

Subscribers can have address changed at will. Give old and new addresses. Date on wrapper denotes end of month in which subscription expires.

Subscription Price:

$3 per year in advance, postage paid, in North America.
$4 per year in foreign countries, postage prepaid.
No back numbers beyond current year.
For sale by newsdealers, generally.

AMERICAN MACHINIST CO., Ltd.,
34 Norfolk St., Strand, London, W. C.

ADPHE. JANSSENS, Ingr.,
16 Place de la République, Paris.
10 A Boulevard Barthélemy, Bruxelles.

V. LOWENER,
Copenhagen,
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Neue Promenade 4, Berlin,
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Puertaferrisa, 7 9 Barcelona,
Representative for Spain.

Entered at New York P. O. as second-class mail matter.

Cable address, "MACHINIST," N. Y.
Lieber's and A B C Codes.

Beginning of a Machinery Industry in Siberia.

In a recent number of "Stahl und Eisen" there is an instructive article on the beginning of the machinery industry in Siberia, based upon information collected from Russian papers. We present an English rendering of most of it herewith:

For Siberia and the development of its economical resources the building of the railroad that cuts through its southern portion signifies a new era. The products of its enormous agricultural territory now have access to Western markets. This stimulates the prosecution of agriculture with modern technical methods, which naturally will create an increasing demand for implements and machines, to use not only in farming operations pure and simple, but in working up the products of the soil and ranch. The manufacture of posset is springing up in Western Siberia, and Danish specialists are producing in establishments patterned after those at home great quantities of butter, which already has begun to play an important role among Siberian exports.

Not less under the influence of the great new avenue of commerce has a complete change been wrought in an important branch of Siberian industry, the production of gold. With the aid of plentiful English and American capital the primitive methods of gold washing that have been in vogue are giving place to the most improved processes, such as are followed in America, Australia and Africa, and the mining operations are being extended from the sands to the primary deposits. This has naturally resulted in a very important increase in the demand for machinery.

Most directly, however, the Siberian Railway itself is helping to develop iron production and machinery manufacture in that country. The inexhaustible richness of the land in excellent iron ores, as well as in coal, greatly assists the growth of this industry. The following data will illustrate the new works that are being established:

In March of this year was founded the "Actiengesellschaft für Bergbau und Metallurgische Industrie im Gebiete des Jenissej-Stromes," for mining purposes, with the exception of precious metals, and for the erection of metallurgical and mechanical works in Yenisei River district. The capitalization is 13,500,000 rubles, and the seat of administration Moscow.

In Tscheljabinsk a machine shop was opened last year by the "Woronischer firma Stoll & Co." The factory is close by the railroad and is being equipped in pretentiously modern style. It is not only arranged for the execution of any ordinary machinery construction and repair work, but makes a specialty of manufacturing agricultural implements.

In Tomsk the first iron and brass foundry has been open a few months—that of the "Genossenschaft Sabbin, Slotnizkij und Masslukow." This establishment takes orders for all kinds of castings, smith work, the erection, completion and repair of steam engines and steam boilers, of steamboats, etc., and for new construction.

At Blagowjeschtschensk, on the Amur, there has been in operation for two years a shipbuilding yard and machine shop, founded by the merchant Schadrin. In the shop are constructed marine engines.

These items concerning new manufactories in iron and machinery lines are, indeed, very incomplete, as proximate information of the recent progress of these industries is lacking. Facilities for spreading information are quite different in vast and sparsely populated Siberia from what they are in Western Europe. Private enterprise in this regard is not allowed much freedom there, and information of the details of many undertakings moves slowly in the administrative circles.

It is to be remarked that most of the docks and shops that had been established at numerous points along Siberian rivers to supply the needs of navigation lines that ply there have recently been renovated to meet the increased demands upon them.

"There can be no doubt," says a Russian authority, "that the enterprises which have been mentioned in brief are only a first beginning, and that the machinery building industry in Siberia is destined for great development so soon as, with the increase of population, establishments are founded in the country itself for manufacture from the agricultural products, which are so rich in the western part of this territory. In the railroad-traversed zone of Tscheljabinsk to the Obi River, and beyond, the land is favorable for the establishment of mills, etc., and the working up of the raw agricultural products." Among the available lines of manufacture mentioned are starch, tallow, soap, stearine candles and leather.

"Together these infant industries which are already started, depend more or less upon the local machinery constructing industry, which is favored by the high cost of transporting apparatus over the long distance from foreign manufactories, and also by the still low wage rates in the district."

The official Russian commercial journal expresses itself concerning Siberian industry thus: "We are by far too little acquainted with Siberia and have too long harbored distrust of the productive forces of that land. But already the first significant step of the same upon the course of industrial development lets it plainly be seen what may be expected from this land so extraordinarily rich in natural gifts."

Perhaps the Siberian outlook was just a little too optimistically judged in Russian official circles after the news of the installation of the Nikolaieff Iron Works at Irkutsk had been received.

Railroad Statistics.

From a summary of the Twelfth Statistical Report of the Interstate Commerce Commission, we learn that on June 30, 1899, the total line mileage of the United States was 189,294. Of this, 11,546 miles were double track, and there were in addition 49,685 miles of yard track and sidings. There were in service 36,703 locomotives, 33,850 passenger cars and 1,295,510 freight cars, not including those owned by private companies and firms. Practically all passenger cars were fitted with train brakes and automatic couplers. Of the freight cars, 730,670 were fitted with train brakes, and 1,067,338 with automatic couplers. The figures relating to accidents show that, according to the law of average, a passenger must travel 61,051,580 miles before meeting with an accident fatal to himself, and 4,239,200 miles before experiencing an accident injurious to himself.

Technical Publication.

An excellent and every way admirable paper was that by Mr. Walter C. Kerr on "The Mechanical Equipment of the New South Station, Boston, Mass.," presented at the New York meeting, in December last, of the American Society of Mechanical Engineers. In commenting upon this paper Prof. Thurston said: "I want to congratulate the society very heartily in having secured this particular paper, and a paper of this particular sort," and all present heartily agreed with him. The Westinghouse Company, Pittsburgh, Pa., has, with admirable business enterprise, reprinted this paper in full, with also the discussion it evoked, and they send it gratuitously to whoever is interested and will ask for it. The pamphlet comprises 126 pages, 6x9 inches, with numerous large half-tones and inset drawings. The work of which it tells was one of the largest of its class in this country, as it was also one of the most successful and satisfactory, and was, it is believed, unique, in that the entire undertaking was carried through from beginning to end by a single firm.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(17) Subscriber, Waterford, N. Y., says: I have some long, slim pieces of tool steel, 24x7/8 inches, to harden, and they must be straight. Will you kindly inform me just how I should go to work to harden them, and if they are crooked after hardening how to straighten them; also if the straightening should be done before or after drawing them? A.—There is a temperature, a little below that at which the colors appear, at which hardened steel may be slightly bent, the temperature being indicated by the steaming of the water from the hardening bath. Files are straightened in this way immediately after withdrawal from the bath. The operation is one requiring considerable skill and experience, and unless you have enough of the work to do to justify the acquiring of this experience, we suggest that your best way would be to send the pieces to a file cutter. We do not believe it possible to harden such pieces and insure their coming from the bath straight. Of course, uniform heating in a lead bath is a precautionary measure, but even this, with the most careful quenching, will not insure straight work.

Personal.

Mr. J. W. Oliver, president of the American Machinery Company, Grand Rapids, Mich., has started for a three or four months' European trip, combining business and recreation.

J. M. Zaremba, at present with the Garvin Machine Company, New York, will sail for Europe in the beginning of August to take the position of first assistant superintendent of the Deutsche Garvin Maschinen Fabrik Aktiengesellschaft, Berlin, Germany.

Obituary.

David Halstead, senior member of the firm of Hal-tead & Co., brass founders and finishers, Philadelphia, Pa., died in that city July 9, sixty-five years old. Mr. Halstead was born in Bolton, England; came to this country when a boy, and had been in business for himself since 1864.

In the waterworks at Coulouvrenier, near Geneva, a large centrifugal pump, made by Sulzer Brothers, of Winterthur, and driven direct by means of two-phase asynchronous electric motors of 1,000 horse-power, has been installed. It is required to lift water to a hight of 460 feet. The necessary pressure is obtained by a simple tandem arrangement of two centrifugal vanes. Injectors are employed to fill the pumps, which are started up with closed valves. In starting, the motor has, therefore, the friction of the water only to overcome. When the normal speed of 600 revolutions per minute has been attained, the valve is slowly opened and the lifting commences. In this manner the motor is gradually loaded. The pump delivers 5,000 gallons per minute, which corresponds to a useful output of 700 horse-power. Current for driving the motor is obtained from the power station in Chèvres.—"The Engineer," London.

There is an enormous wrought-iron pillar in India, close to the Kutub, near Delhi, which weighs 10 tons, and is said to be 1,800 years old. The manufacture of cast steel in India can be traced back for over 2,000 years.

Commercial Review.

NEW YORK, Saturday, July 14.

ENGINES AND OTHER MACHINERY.

While the engine market is rather quiet, it is better than usual for this time of year, especially for a Presidential campaign year. At some agencies the orders received of late have belied unfavorable tendencies.

The acrobatic iron market, viewed from the machinery man's peanut gallery, has been taking altogether too fast a tumble, and arouses fears that the roof may come down. The market was up too high and was bound to drop, but it would have pleased the audience better had the descent been more gradual. Engine prices on both high-speed and Corliss types show inclination to fall in places, but the comedowns are rather in the nature of concessions in bidding than of an open break. The cost of material is not an all-important factor in the cost of a fine engine. Last year's prodigious mark-ups were due as much to the stuffed conditions of shops that had gorged themselves at the start with cheap orders as to the rise in cost of material. Nor has this condition yet been entirely removed. A case is reported where a company which is still crowded on deliveries asked on an engine a price some 30 per cent. higher than would probably have been demanded had they been able to execute the order quickly with ease. As the present relative scarcity of orders comes to be felt, prices will naturally respond to it. We hear that a cut of $400 was lately made in bidding on a job amounting to $2,000. The concession was so excessive that the buyer became suspicious of this bidder and kept shy of him.

However, let it be understood that the leading engine concerns, or a good percentage of them at least, have not yet had to cut prices, and if fall trade sets in early and strong and is aided by a recovered iron market, they may not have to do so at all.

The Hooven, Owens & Rentschler Company's New York branch has been decidedly successful of late in closing up contracts for engines. Among the sales may be mentioned: A tandem compound 450 horse-power engine for the Thos. G. Plant Company, shoe manufacturers, Boston, Mass.; a 500 horse-power engine for the Lancaster (Pa.) Mechanicsburg & New Holland Railway Company, to drive a Westinghouse generator; two 350 horse-power engines for an electric plant being erected at Pen Argyl, Pa., by the Bethlehem Construction Company; a 175 horse-power engine for the Union Bag & Paper Company's factory at Sandy Hill, N. Y., and a 150 horse-power engine for the paper mill of Charles G. Weeks, Skaneateles, N. Y.

The Hyatt Roller Bearing Company, Harrison, N. J., and New York city, has contracted with the Goulds Manufacturing

Company, pump manufacturer, Seneca Falls, N. Y., to supply its new power transmission equipment, consisting of shaft direct connected to engine, four quills, roller bearings, friction clutches, etc. The Hyatt Roller Bearing Company reports good demand for its shafting bearings, and is pleased with the way its goods are received by machine tool builders and other workers in iron and steel.

JOTTINGS THROUGH THE MIDDLE STATES.

The Betts Machine Company, Wilmington, Del., is finishing up a lot of six tire mills for the Standard Steel Works of Philadelphia and Burnham, Pa., manufacturers of locomotive car wheels for the Baldwin Locomotive Works. These six will raise the number of Betts tire mills in these works to thirty-six. A large portion of the erecting floor of the Betts shop is taken up by a 7-foot planer with 67-foot bed and 40-foot table; total weight, about 135,000 pounds. This will shortly be shipped to the steel works of Fried. Krupp, at Essen, Germany, to join the five other Betts planers and three Betts boring mills now in use there. The Betts shop is still running twenty-four hours a day, and the two 60-foot extensions recently added to the main shop leave it still cramped for space. The number of orders on the books keeps up to the last year's abnormal, with no rest for the weary in sight.

Hilles & Jones Company, Wilmington, Del., is no less busy than it has been for the past year, and it is a struggle to keep within hailing distance of the last order. Two large punching machines, motor driven, have recently been shipped to Vladivostock, Siberia, for use on the Chinese Eastern Railway. Several bending rolls and some special horizontal punching machinery have been been built for the new shipyard of the New York Ship Building Company, at Camden, N. J. The Brown Hoisting & Conveying Machine Company, of Cleveland, Ohio, has recently received an 86-inch Hilles & Jones plate-shearing machine, and to the Cramp shipyard goes an imposing set of motor-driven bending rolls, 26 feet long; bottom roll, 27 inches; two top rolls, each 20 inches in diameter. While feeling the spirit of unrest which comes over us some few months before the Presidential contest, there is in this shop a quiet confidence in the stability of prices and demand which is reassuring for the immediate future.

American Saw Company, Trenton, N. J., is very busy, although it has felt the effects of the sudden changes in the sheet-steel market. The drop-forging department of the shop is somewhat behind its orders, and as these are coming in at a fairly even rate, it promises to remain behind for a while.

The Storey Motor & Machine Company is in the throes of removal from Trenton, N. J., to Harrison, N. J. Some ingenious arrangement has been necessary to allow of the removal without interfering with the course of the work in hand, but it has been effected, and orders will not be delayed more than a few days. With the increase in facilities and capital more to the Metropolitan Street Railway Company, New York City.

The Wyoming Shovel Works, Wyoming, Pa., have purchased, through Woolston & Brew, 141 Broadway, a 300 horse-power C. H. Brown engine, which will be used for operating a rope drive. The factory is being remodeled and extended, and the equipment will, it is understood be enlarged. It is likely, therefore, that the company will be in the market for tools, although several months may elapse before they are required.

In view of the general slackening of machinery orders at this time, it is especially worthy of note to hear from a company whose business has lately been on the increase. The American Turret Lathe Company, Wilmington, Del., tells us that the outlook, so far as it can see, is very encouraging. It had more orders on hand July 1 than it had June 1 by several thousand dollars. Its June shipments were the largest of any month since it has been doing business. It has orders now for eight machines to go to the Philadelphia district, including some of the more prominent concerns, such as Wm. Sellers & Co., New York Ship Building Company, of Camden, N. J.; Pennsylvania Iron Works Company, H. W. Butterworth & Sons Company, and Williamson Bros. Company. The outlook for foreign trade is also very good. It has shipped a number of machines recently to England, Germany and France, and has sent over its operators to start them up. It is now bringing out a 20-inch semi-automatic turret lathe, on which it expects to make a special drive. This machine is so designed that it can be sold at a very low price. It will also bring out a 32-inch machine, which will make its line of heavy turret lathes complete. In addition, it is bringing out a universal tool grinder for grinding lathe and planer tools, and also for making and sharpening turret lathe tools of all kinds, both for cast-iron machines and for rod-working machines. The company is adding a number of new machine tools to its equipment, but will be obliged to have certain portions of its work done outside in order to make better deliveries.

MACHINERY EXPORTS FOR MAY.

	MAY—				ELEVEN MONTHS ENDING MAY—					
	1899		1900		1898		1899		1900	
	Quantities	Values.	Quantities	Values.	Quantities	Values.	Quantities	Values.	Quantities	Values.
		Dollars.		*Dollars.*		*Dollars.*		*Dollars.*		*Dollars.*
Cash Registers	....	(*b*)	....	70,988	....	(*b*)	....	(*b*)	.....	755,212
Electrical Machinery	....	241,103	....	538,678	....	1,883,306	....	2,517,797	.....	3,834,317
Laundry Machinery	....	(*b*)	....	59,824	....	(*b*)	....	(*b*)	.....	402,831
Metal-working Machinery	....	471,445	....	591,532	....	4,164,921	....	5,882,165	.....	6,593,263
Printing Presses, and parts of	....	75,513	....	99,344	....	818,015	....	772 181	.....	1,100,727
Pumps and Pumping Machinery	....	255,547	....	222,387	....	1,835,036	....	2,484,783	.....	2,836,631
Sewing Machines, and parts of	....	327,477	....	393,283	....	2,810,429	....	2,949,164	.....	4,115,953
Shoe Machinery	....	95,571	....	72,957	....	832,936	....	777,277	.....	1,080,391
Steam Engines, and parts of—										
Fire	2	9,913	1	5,180	6	1,969	3	10,173	2	13,315
Locomotive	29	211,128	45	421,731	419	3,429,665	443	4,009,347	496	5,227,106
Stationary	103	29,612	95	61,974	522	377,017	519	286,709	1,102	582,111
Parts of, and Boilers	....	88,341	....	190,509	....	880,111	....	1,049,412	.....	1,623,557
Typewriting Machines, and parts of	....	247,787	....	223,827	....	1,738,703	....	2,213 540	.....	2,481,699
All other machinery, etc	....	1,558,472	....	2,069,649	....	2,109,446	....	17,056,510	.....	19,876,940

(*b*) Included in "All other machinery" prior to July, 1899.

Recent sales of Roney mechanical stokers included some 6,000 horse-power to the American Sugar Refining Company, which is putting up a new building; 2,500 horse-power for an electric station at Seattle, Wash., and 7,000 horse-power which the expansion of this company will give it, the chances of realization of the plans of the founder of the company and his assistants are greatly increased, and they look forward to a continuation of the good fortune which has hitherto favored them.

The Pennsylvania Railroad Company is erecting a new boiler-house at Altoona, Pa. Westinghouse, Church, Kerr & Co. are general contractors, have drawn up the plans, have let the boiler contract calling for upward of 1,000 horse-power, and will put in outfit of Roney mechanical stokers. It is quite probable that this new boiler installation at the Altoona shops is the precursor of additions to the machinery equipment, for which tool builders may therefore keep a weather eye.

CINCINNATI REPORT.

The summer dullness feature continues unabated in the local machinery market. A few manufacturers of machine tools, upright drills, lathes, etc., have received encouragement in the shape of some substantial new orders this month. Two or three of the largest firms report a number of good-sized orders from Germany and England. One concern notes a pleasant little increase in inquiry and purchase from the East and South. A consensus of opinion suggests conditions considerably improved over last month, and while there is a let-up in actual new business, still confidence is inspired that plants may be kept going until the fall, when business in its usual volume will resume. In reference to foundry conditions there has been no manifes-

tation among local concerns and makers of machine tools and kindred supplies. They are anticipating no trouble from this source. The molders of Cleveland are out, and agitation is on here to that end, but it is believed their efforts will be unsuccessful.

A letter has just been received by local officials of the Cincinnati Milling Machine Company from Secretary and Treasurer Fred A. Geier, now in Europe, which says he and Mr. Hoefinghoff, of the Bickford Drill and Tool Company, have been down in Italy, and consider the prospects good there for the introduction of special types of machinery. They are working towards St. Petersburg and Stockholm, and thence will go to Berlin again, and from there to London, and back home, expecting to arrive in this country the latter part of August. They spent about a month in Paris at the Exposition.

Many conservative officials of the larger concerns believe that a general disposition to hold off on the part of buyers is attributable to the conviction that there will be a great drop in prices soon. The local machine trade is quite well satisfied with the way the South is improving in the matter of buying and inquiries for high grades of machinery. A nice order was filled a day or so ago from a large Cincinnati concern for a half-dozen milling machines for points in England. Collections as a rule are good.

CHICAGO MACHINERY MARKET.

Among the few metal industries which, during the past few weeks, have been favored with exceptional activity are the brass and copper works. Their wares have been in unusual demand, largely for manufacturing purposes. Producers of machine shop supplies are almost a unit in describing the present state of trade as quiet. It is even a little more than the ordinary midsummer dullness. As gathered from a number of Western plants, the report is that business is "slack," "fair," and "bad," with an occasional "good." Those machine shops which do a general jobbing business are among the worst sufferers in the present lull. The outside public is not interested to any considerable degree in new work, and a vigilant skirmish for orders is the antecedent to uninterrupted operation of shops. Shops connected with manufacturing plants are faring better. The larger plants are running, though not, as a rule, at fullest capacity. And the Chicago reports do not compare favorably with those in the country.

It is somewhat remarkable in conjunction with this state of trade that there is not more complaint among the shops, or among the makers and sellers of shop supplies. Everywhere is seen a cheerful attitude, as if dull times were the most ordinary happenings in the world, devoid of inconvenience or pecuniary loss to anybody. The secret for this unconcern seems to be the conviction that the existing quiet is destined to a short life. It is difficult to find anyone connected with the trade who does not talk of the time when business is to be restored to full activity. Some put off the day of deliverance until after the election; others think a brisk trade will awaken early in the fall. And the soul of patience awaiting that event is a common commodity.

The lack of large and numerous orders is ascribed to accidental, rather than to essential, causes. The fall in prices of iron and steel is held to be a leading culprit. Once the bottom is reached, a change of tone is anticipated. The slow-dragging strikes are another attributed explanation. And a few people say the Presidential year is responsible for a goodly share of the hesitation. But back of these temporary influences there is a manifest intention of buyers to invade the market with their needs. Not all of them are held in check. Reports are not uncommon that within the past few days inquiry for all kinds of material has been almost vivacious. The question is whether it is a spurt or the forerunner of more lasting buying.

Some interest is displayed in the query whether crucible steel under the coming consolidated production will advance, and thus affect the products of crucible steel, but no one seems sufficiently interested to buy more lavishly in anticipation of that contingency.

Quotations.

NEW YORK, Monday, July 16, 1900.

Iron—American Pig, tidewater delivery:—

Pensylvania Irons:	
No. 1 X foundry	$17 75 @ $19 00
No. 2 X foundry	16 75 @ 18 00
No. 2 plain	16 25 @ 17 00
Alabama Irons:	
No. 1 foundry, or soft	18 75 @ 19 75
No. 2 foundry, or soft	17 75 @ 18 75
No. 3 foundry	16 75 @ 17 75
Foundry forge	16 25 @ 17 00

Bar Iron—Base sizes—The price on dock is 1.50 @ 1.60c. for good refined brands, and 2 @ 2.10c. for same from store.

Tool Steel—Base sizes—Good standard quality, 7 @ 8c.; extra grades, 10 @ 14c.; special grades, 16c and upward.

Machinery Steel — Base sizes — From store, 2.10 @ 2.30c.

Cold Rolled Steel Shafting—Base sizes —From store, 3¼ @ 3½c.

Copper—Lake Superior ingot, 16⅜ @ 16½c.; electrolytic, 16¼ @ 16⅜c.; casting, 16⅛ @ 16⅜c.

Pig Tin—34¼c. for 5 and 10-ton lots, f. o. b.

Lead—For wholesale lots, 4c., with .02½ @ .05c. extra for carloads, New York.

Spelter—Prime Western, 4.25c., New York delivery.

Antimony — Cookson's, 10¾ @ 11c.; United States, 9⅜ @ 9½c.

Lard Oil—Prime City, 56 @ 58c., in one to five-barrel lots.

The Paris Exposition —VIII.

EDITORIAL CORRESPONDENCE.

SOME ANGLO-AMERICAN TOOLS.

The firm of W. H. Ward & Co., of Birmingham, exhibits some tools which are evidently designed to do the same class of work as is being done by modern tools manufactured in America, and to do it in essentially the same manner. Fig. 40 represents a flat turret lathe exhibited by them, which will be seen to be quite American, but in which the carriage, instead of being fed by a splined rod as we do it, and as would certainly be required in American practice, is fed by a lead screw, which is also used when cutting screws with the dies. For driving the lead screw the Norton device is used, and this, together with changes made by the lever seen at the left, gives forty different rates of feed. The builders make a point of having a lead screw to produce accurate threads, and since they say that lathes of this kind not having a lead screw are unable to cut accurate, long threads, it is of course fair to ask how long any great degree of accuracy will be retained in a screw that is used for all the feeding as well as for threading. It will, however, undoubtedly be retained much longer than would be case with a screw of the size that most any one of our builders would be likely to put in if he used one at all.

This lathe has the automatic roller feed for the bar, and both this and the chuck are controlled by the shorter one of the two vertical levers, while the friction clutch by which the back gears are thrown in or out of action is controlled by the longer one. There are two ratios of back gearing—one 5 to 1, the other 16 to 1. The feed is reversible by the lever under the bed, is automatically disengaged, and the turret automatically revolved by the adjustable stop-bar at the right, while the short lever at the left just below the base of the turret enables the latter to be unlocked and revolved to any position in either direction. The lever above the turret gives rapid movement to the cut-off tool and the knurled head below gives a slow, positive movement to the same.

When I visited the Ward shops, three years ago, they said they were students of and admirers of American machine-tool practice, but that they thought many of the details of American tools were too light to stand up well under the conditions found in British workshops. The tools illustrated may, I suppose, be taken, therefore, as representing what they consider will stand well under such conditions. The lead screw in the lathe, Fig. 40, is 2 inches diameter, four threads per inch. The machine has a 2½-inch hole through the spindle; the large step of the cone is 12¼ inches diameter, for 3-inch belt. The back gears are 7 pitch, the main spindle gear having 84 teeth. The turret in Fig. 41 is 15½ inches diameter across the flats.

The tool Fig. 41 is in some respects

similar to the one last described, but is intended for finishing castings and a variety of irregular work with tools held in a revolving tool-post and an inclined turret, *a la* Gisholt, there being also revolving automatic stops for all the tools.

This machine has an automatic cross-feed which is actuated by the splined rod seen below the lead screw, and driven from it by gears at the end of the lathe, both the carriage and turret feeding being done entirely by the threads of the lead screw.

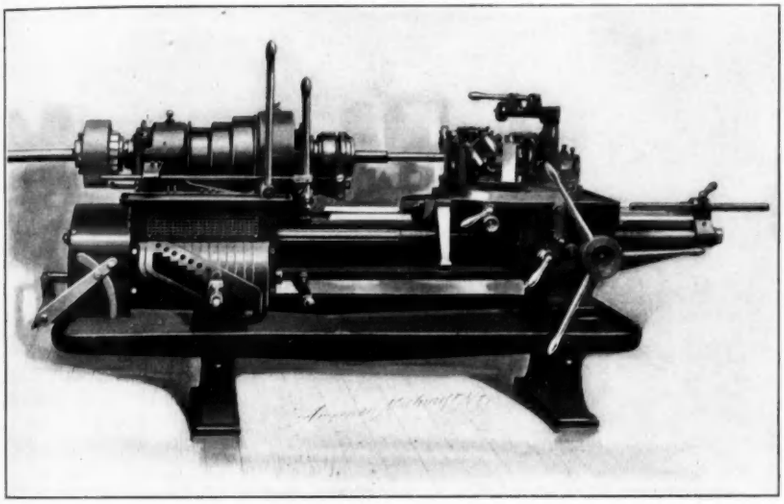


FIG. 40. FLAT TURRET LATHE EXHIBITED BY W. H. WARD & CO., OF BIRMINGHAM.

At Fig. 42 is seen a milling machine of the Lincoln type, which is exhibited by the same builders. The uprights are adjustable toward or from the platen, and when adjusted to position, are tied together at the top by the cylindrical bar seen, which is clamped in each upright. The heads are counterbalanced and are clamped to the uprights by two binding bolts. The table feeds range from 29 to 80 revolutions of spindle per inch in six steps, three of these being by the feed cone pulley and the others by one of the short levers seen in front of the machine at the left; the other lever reversing the direction of the feed. There are three-stepped cones for driving the spindles and two speeds for the counter.

A NEW GENERATING BEVEL GEAR CUTTER.

A very prominent feature of the machine tool exhibit on the Champ de Mars are the machines for cutting bevel gears. Three years ago when I visited European machine shops I found in them evidences that the problem of cutting bevel gears had been given much more study than with us, and that there were very many interesting and good machines for the purpose, none, however, at all equal in refinement to the Bilgram machine, then, as now, made on this side by Smith & Coventry, of Manchester. It is evident from what is to be seen here that during this three-year interval much progress has been made along this line. Smith & Coventry exhibit an experimental machine of their own which generates an involute tooth curve by a new method, and planes both sides of a tooth space simultaneously. It is a very interesting machine, which I hope to be able to give an account of later. There are other machines that are of interest also, but all the others copy a tooth template or form except the one shown in Fig. 43, which seems to me to be one of the most interesting machine tools in the exhibition. It is a new invention by Mr. L. Monneret, the directing engineer of the machine tool building establishment of H. Ernault, of Paris, and the machine generates the tooth surface upon a principle which is the same as that employed by Bilgram, Warren and Beale, but by a mechanical structure entirely novel, rather difficult to fully understand when one has to dig it out for himself, but decidedly interesting. The geometric principles upon which the machine's action is based have been fully set forth in our columns in connection with the American machines referred to, and need not be gone over now. It is sufficient to say that the cutting tool represents a tooth upon a crown gear; it reciprocates for its cutting action, while at the same time it is rotated in the arc of a circle representing the crown gear, while the blank being cut is at the same time rotated at its proper relative rate, the same as though both the crown gear and the gear being cut were complete and were in engagement with each other. The principle is illustrated by Fig. 44, in which *A* may represent the pinion being cut and *B* the crown gear, all the teeth of which are, in the machine, removed, except one, which one represents a section of a tooth of the crown gear, is made of steel, given a reciprocity motion, and otherwise adapted for cutting the teeth of its mating wheel as they both revolve. Fig. 45 gives a plan view and elevations from three different view points, in which *A* (plan view) is the cutting tool, not however shown as it is actually made, for it is really a turned tool made in the lathe, as shown in the photograph. *B* is the work arbor, which is mounted in a saddle that rests upon the base of the machine, is pivoted at *C*, and can be set at any angle, to suit the gear to be cut. The cone pulley and back gears shown do not give a rotary motion to the main spindle and the tool slide, but serve only to impart the reciprocating motion to the tool by means of a crank disk and connecting rod, a portion of said rod being visible in the photograph, Fig. 43.

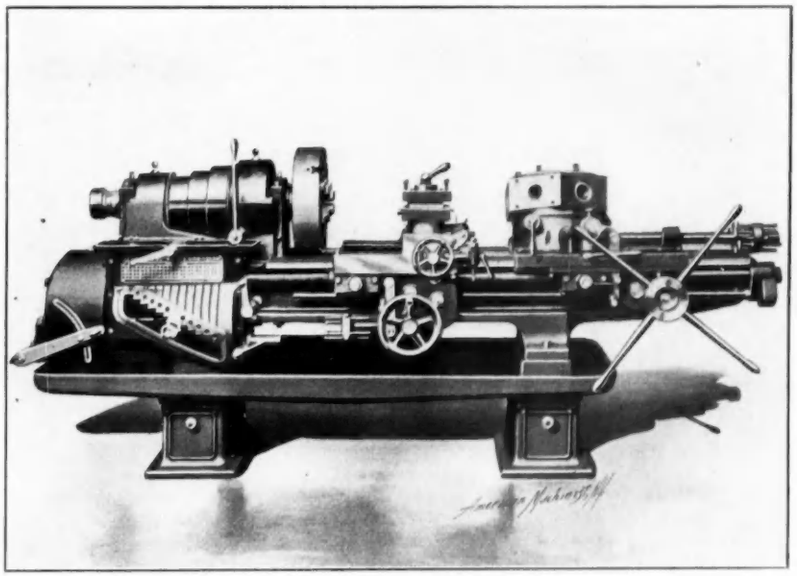


FIG. 41. TURRET MACHINE EXHIBITED BY W. H. WARD & CO.

When the machine is in action the blank being cut continuously rotates at such a speed relative to the motion of the tool slide that the latter makes as many cutting strokes during one revolution of the blank as there are teeth to be cut in it, this ratio of rotative to reciprocative movement be-

ing obtained by simply putting on (by a table) the proper change gears at the end of the machine, the same as in gearing up a lathe. Thus, the tool makes a cut along one side of a given tooth, is lifted out of its path for the return stroke by the friction device worked by the cord seen in Fig. 43, and when it makes its next forward stroke, takes a cut along the corresponding side of the next tooth, the rotation of the blank meantime having been just right for the proper indexing.

Since the rotative movement of the blank is continuous and takes place while the tool is moving in a straight, radial line, the tooth produced is, of course, helical, or what would commonly be called spiral, instead of straight, as we are accustomed to cut them. These helical teeth are, however, claimed to be an advantage and to conduce to smooth running; while it is to be noted that the machine automatically takes care of the point of having the helices of two mating gears match each other, for the simple reason that all gears of the same pitch must have the same rotative speed at the pitch line, regardless of their size or number of teeth, in order to make the indexing right; and if they rotate at the same lineal, pitch-line speed during the cutting stroke, then, of course, the pitch or lead of the helix will be the same. It follows from this, too, that the pitch of the helix is not subject to the choice of the operator, but necessarily varies with the pitch of the gear, being, in fact, not readily perceptible in gears of moderate or fine pitches.

Now it must be kept in mind that the cutting tool is set, or rather that the blank is set in relation to it, at the full depth of the tooth before cutting begins; but that the plate which carries the reciprocating tool slide is rotated one way or the other about its center until the tool or, in other words, the single tooth of the crown gear, is out of contact with the blank either above or below it, and the feed motion consists of simply rotating the face gear (or the tool slide carrying plate), to carry the cutter through what would be the arc of action or of engagement of the crown gear and its pinion. This is simple enough so far as the tool slide is concerned, because the plate upon which it slides has no other motion, and needs only to be rotated slightly at the end of each complete revolution of the blank to give the tool a new cut, but at the same time the wheel being cut must be given a corresponding rotative motion in order to generate the tooth curve; and since this blank already has a continuous (and relatively rapid) rotative movement—equal to one tooth for each cutting stroke, the rotative movement necessary for the generation of the involute tooth curve must be simply a modification of the rotative movement already taking place. It is this which makes the machine rather complicated, but the means by which it is accomplished are exceedingly interesting, and are of such a nature as to make the setting up for any given job of gear cutting exceedingly simple and easily performed, the machine itself taking care of its more intricate functions automatically.

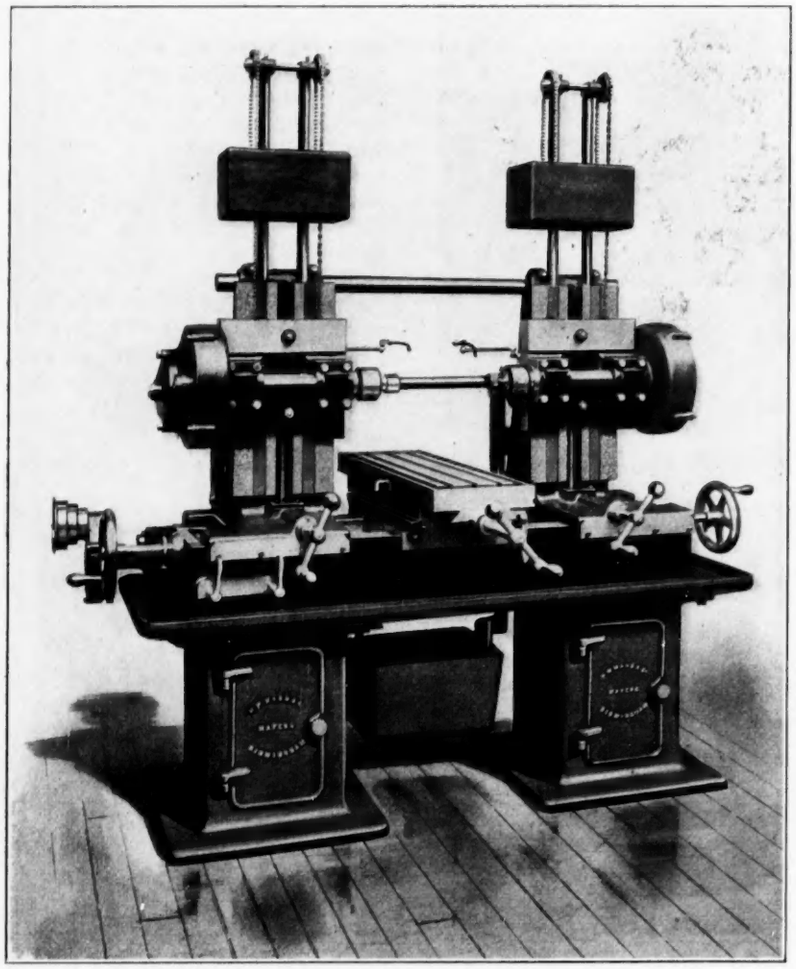


FIG. 42. DOUBLE LINCOLN MILLER EXHIBITED BY W. H. WARD & CO.

The change gears give motion to a shaft which passes through under the cone pulley shaft to a point near the central pivot *C*, where it drives a bevel gear having a vertical axis concentric with said pivot. Part of this shaft is seen in the photograph, Fig. 43. From this bevel gear is driven the short radial horizontal shaft also seen in the photograph, which shaft *seems* to have up it three miter gears; it is really a sleeve and shaft, each with independent rotative motions, as will be explained further on. The continuous rotative movement for the blank is thus carried from the change gears through the vertical pivot *C*, and the inner one of the two horizontal parallel shafts seen in Fig. 43 to the inner one of the two similar spur-gear trains disposed vertically and seen near the left of Fig. 43; the uppermost one of these being seen in the plan, Fig. 45, and there designated *D*. From here this motion is carried, by means not necessary to trace out in detail, to the worm shaft *E*, which rotates the work spindle and blank.

The feed motion takes place intermittently at each complete rotation of the blank, and it now remains to trace it out. On the work spindle is a spur gear seen plainly in Fig. 43, and designated *F* in the drawing, Fig. 45. It drives an equal spur gear that gives motion to a slotted crank-disk, and from this disk the feed ratchet wheel *H* is driven by a reversible pawl. This ratchet wheel is thus given a movement at each rotation of the blank, which intermittent rotation is carried through the miter gears seen at the right of it in the plan view, to the screw *I*, which is parallel to the worm shaft *E* and screw *I*, and the worm is splined on *E*, so that it can slide upon it; being held in a sort of cradle or box which extends over the screw *I* and is fitted to the latter, so that, when the screw *I* is rotated, it moves the worm longitudinally upon the splined worm shaft *E*, and the worm thus acts as a moving rack to rotate the worm wheel and work spindle independently of the motion imparted to the same worm wheel by the same worm, by virtue of its rotative movement. It is this longitudinal movement of the worm, acting as a rack, that modifies the rotative movement of the blank to agree with the rotative movement

of the tool slide plate (or crown gear) for the feed, as previously mentioned.

Now, since the blank and the tool slide plate must rotate together for the feed at the proper relative ratio, further mechanism of an interesting character is provided for this. At the other end of the shaft on which the ratchet wheel is placed is a spur gear (marked *J* on the plan, Fig. 45), and this gear is the driver of the outer one of the two similar trains of gears seen side by side near the left of Fig. 43. Thus motion is given to the outer one of the two parallel horizontal shafts and to the outer gears seen, which move a shaft passing through the before mentioned horizontal radial sleeve to the central pivot *C*, where it moves a shaft passing down through the center of this pivot, and giving motion blow to a screw which lies horizontally under this pivot, and is supported in brackets that are attached to the pivoted saddle that carries the work spindle and other described mechanism; this last mentioned screw being thus kept always parallel to the screw *I*. The center of this last mentioned screw is designated *K* in the side elevation of the machine, Fig. 45, and the nut on this screw is also a slide; the arrangement being shown by the diagram, Fig. 46, where the nut is pivoted to a block which can slide in *a;* and as *a* is rigidly attached to the slide *b*, the latter is given motion by the screw, the rate of which varies with the angle to which the screw is set; the motion of the nut being, in fact, resolved into two components, which are at right angles to each other. This lower slide *b* has a rack attached to its under surface, and this rack, by rotating a shaft with a pinion, gives motion, through a train of spur gears, to the plate which carries the tool slide, and the rate of this motion of course depends upon the angle of the screw, which again is always parallel to the screw *I*, the position of which is determined by the angle of the pitch cone of the gear to be produced; so that this proper relative motion of the blank and of the plate or slide representing the crown gear is always automatically secured in setting the saddle to the proper angle, and needs no attention from the operator. The final gear of the last mentioned train *L*, Fig. 45, has a vertical rack *M* engaging with it, which rack, by means of movable tappets seen in Fig. 45, releases the shipper and allows the machine to stop.

The machine shown which has the general dimensions indicated in Fig. 45, will

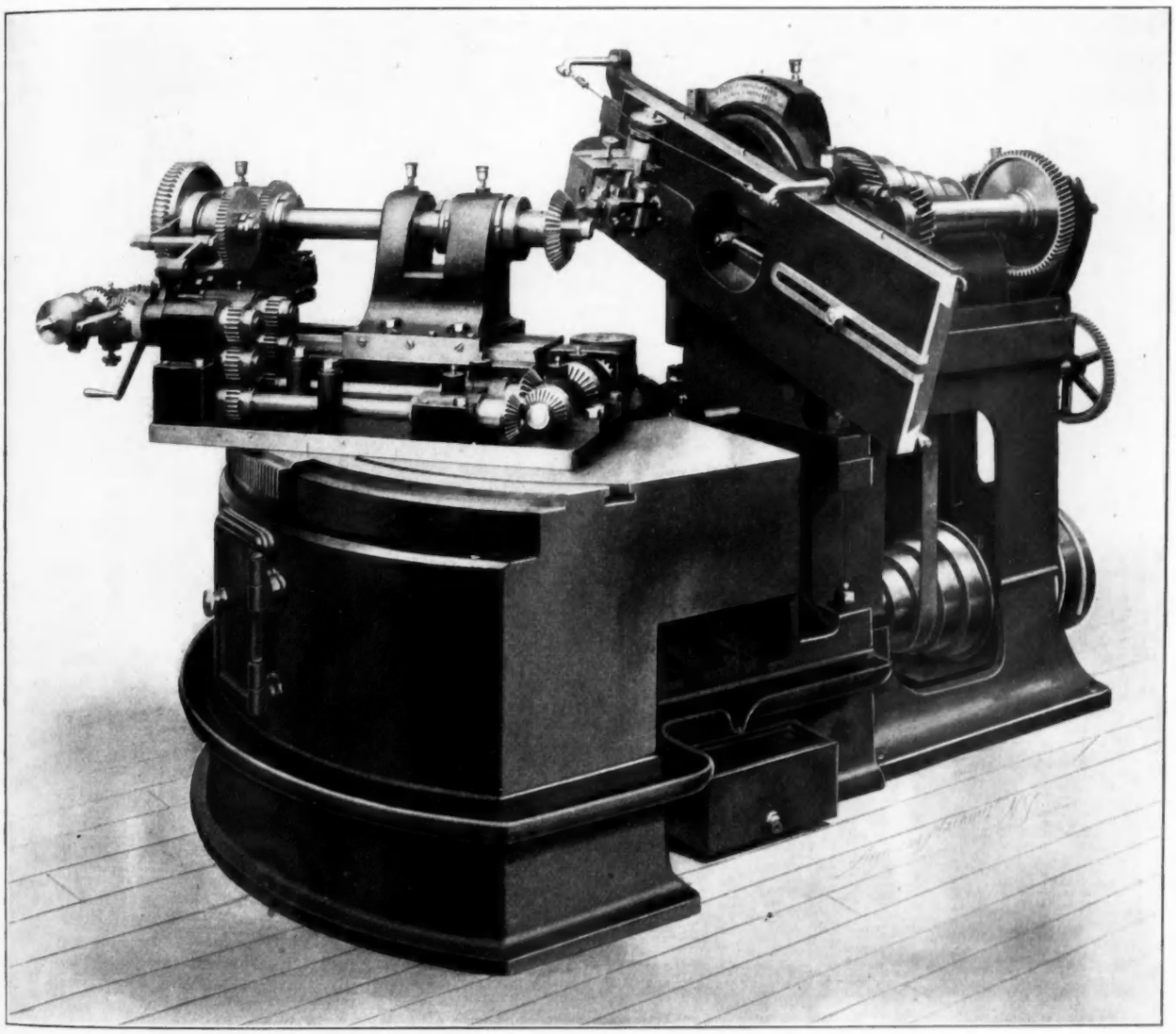


FIG. 43. AUTOMATIC BEVEL GEAR GENERATING MACHINE EXHIBITED AT PARIS, THE INVENTION OF MR. L. MONNERET.

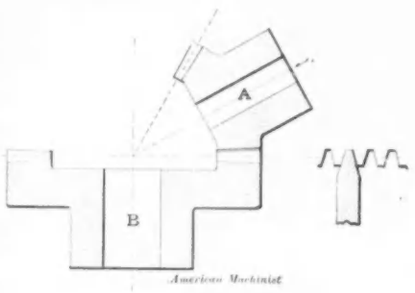


Fig. 44

ILLUSTRATING THE PRINCIPLE OF THE BEVEL GEAR GENERATING MACHINE.

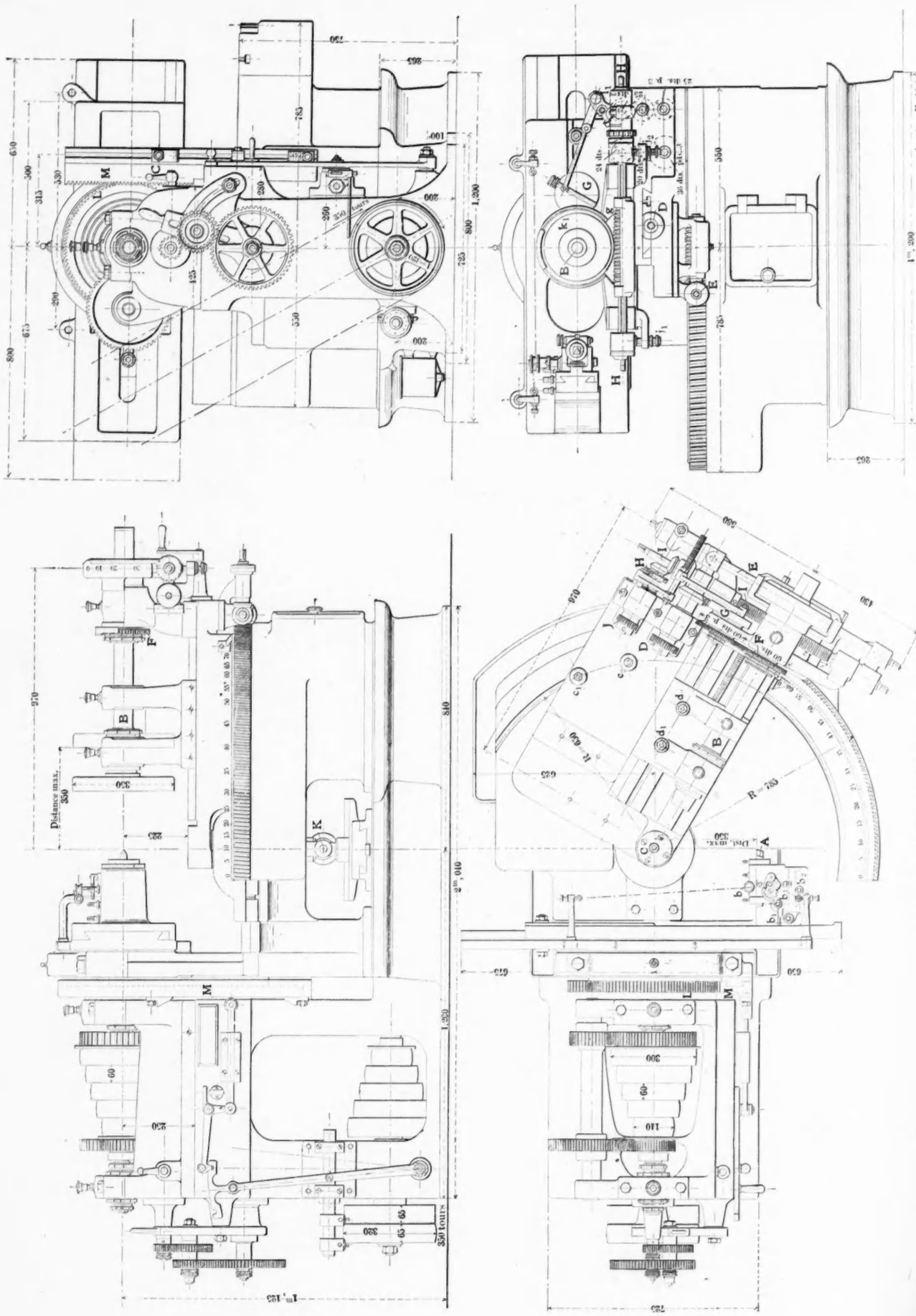


FIG. 45. FRENCH AUTOMATIC BEVEL GEAR GENERATING AND PLANING MACHINE.

cut gears up to the size indicated in Fig. 47. The machine exhibited here is, I am informed, the first one built, and it will probably be readily conceded that its inventor has done some thinking and that he knows a thing or two about machine design as well as bevel gears.

HELICAL SPUR GEARS ON FRENCH TOOLS.

It will be noticed by looking at Fig. 43 that the back gears are helical and these helical gears are much used on French machine tools. It is claimed that they give a smoothness of action not attainable otherwise, but those of our builders who get ordinary gears good enough to suit their ambition declare that helical spur gears are only a means of hiding the imperfections of cutting. It seems to me that since all gears must in practice have some imperfections, original or acquired, this is in a sense begging the question.

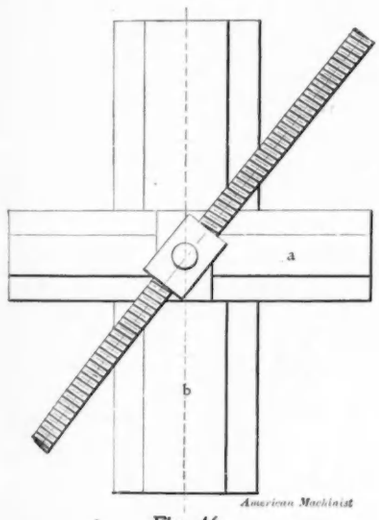


Fig. 46

DIAGRAM OF ONE OF THE PRINCIPAL DETAILS OF THE BEVEL GEAR GENERATOR.

However that may be, they are much in evidence here on French and Belgian tools, and there are some curiosities to be seen among them. Looking again at Fig. 43, it will be seen that the helix of both the gears on the back-gear quill are left-handed, and so far as can be judged the angle is the same. That is to say, it seems probable that the pitch or lead of the helix on the pinion has been reduced as compared with that of the large gear, so as to make the angle of the teeth practically the same; and so far as I have noticed, this is the universal practice. Since, however, the teeth of the pinion exert a force greater than that which is exerted upon the teeth of the gear in proportion to their relative diameters, it would seem as though the end thrust upon the quill would in this case be in a forward direction and would not be balanced, as it is evidently intended to have it, or, as it could be practically, I suppose, by varying the angles proportionately to the diameter of the gears. But a still more interesting point in this connection is that this is, I believe, the only pair of back gears in the whole exhibition that have the spirals on both the gears in the same direction. All the rest of them have one gear made with right-hand spiral teeth and the other with left-hand, manifestly with the intention of balancing the end thrust of one wheel against that of the other, and thus neutralizing it. All the tools of Bariquand et Marre, of Paris, for instance, are made in this way; but a friend who is connected with a prominent American establishment, and who has been studying machine tools here, calls my attention to the obvious fact that this is wrong, and that by making the teeth of one wheel incline one way and those of the other in the opposite direction the very evil that is sought to be avoided is introduced. This results from the simple fact that one of the gears is driven, while the other is a driver, and so, though right and left, they both exert thrust in the same direction.

M. Monneret seems to have seen this point when designing his latest tool, although the man in charge of it declared himself to be unable to tell me why it was different in this respect from the others, saying only, with a shrug of the shoulders, that M. Monneret was the inventor of the machine, and giving me to understand that the responsibility was upon him, and no doubt he could explain why he had thus cast precedent aside. It is clear that he was right in doing so, however, though I think there is still considerable end thrust coming from the fact that the pinion exerts more force than the gear inversely proportioned to their diameters, and no attempt seems to have been made by any of them to compensate for this by varying the angles to suit it. And in fact we should not expect such an attempt, nor any perception of the point involved, from people who have manifestly simply copied each other, without doing a particle of independent thinking regarding the real action of the gears so made. One of the strong points of evidence that M. Monneret is in the habit of doing independent thinking is to be seen in the act that in this matter he has not blindly followed the common custom, but has set it aside for reasons that were clear to him and valid.

SOME DISCORD—THE GERMAN TARIFF ON MACHINE TOOLS AND GERMANY'S REAL INDUSTRIAL INTERESTS.

It is not being found possible to maintain entire harmony among the New England tool builders who arranged for a joint exhibit on the Champ de Mars. What some of them want to do, others do not want to do, and the net result is that little or nothing whatever is being done there; some of the exhibitors being free to say that they are disgusted with the Champ de Mars exhibit and will have as little to do with it as possible. At first it was proposed to jointly employ a man familiar with machinery and with all modern languages to engage the attention of interested visitors at Champ de Mars and induce them to go out to Vincennes, where of course all the exhibitors would have an equal chance with them. Unity of action in this matter could not be secured, and as time went on and it seemed unlikely that anyone would be placed in charge of the space, it was proposed by those who are represented by Schuchardt & Schütte that their engineer, at present in Paris, Mr. Salomon, should be permitted to place a desk in the space and to meet people there and get them to go out to Vincennes if possible. This was vigorously objected to by those who are not represented by Schuchardt & Schütte, and so nothing has been done, and nothing seems likely to be done that will be effective, and I gather that those who went into the combination space affair will in future exhibitions be sure to keep out of such arrangements; although it ought to have been possible to have avoided most of the troubles com-

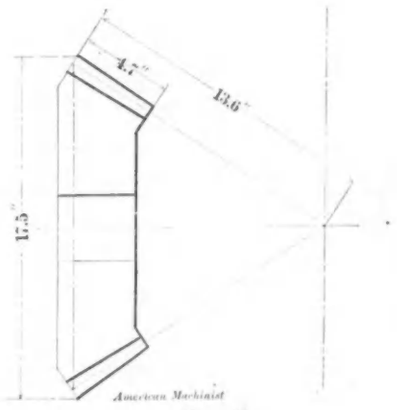


Fig. 47

plained of if there had been, in the first place, either a board or a single director elected with full authority to do what seemed best, or if, on the other hand, the more democratic plan of having each question settled by a majority vote of the members had been followed.

In the meantime, however, the exhibit at Vincennes is proving more and more satisfactory to those who have their representatives there to meet and interest people who call. The class of people who go there are almost entirely those who are really interested in machinery and go on purpose to see it, and often to select for immediate or future placing of orders. I met there, the other day, a German bolt manufacturer, who said that he had expected to see all he wanted of the exhibit there in a few hours, but who spent a day without getting through it, and went again to finish, declaring to me that there was more to be seen there of real interest and value than in all the Champ de Mars machinery put together.

He proved a very interesting acquaint-

ance; his factory (a large one) is largely equipped with American machinery; he has been a subscriber to and reader of the "American Machinist" since its beginning, and declares that very much of Germany's present attainments and success in manufacturing is due to the fact that German manufacturers have been ready to throw aside the old methods of making things, to adopt the new or American methods, and to buy from America the machinery for doing it.

He says he considers it to be certain that within a short time the German Government will levy a greatly increased import tariff upon machine tools for the special purpose of keeping American tools out and giving German tool builders a monopoly of the market. He himself thinks this will be quite prejudicial to Germany's real interests, because, while it will tend to enrich the German tool builders, it will prevent or throw obstacles in the way of users of tools who desire the best and who, by using such tools, will do far more to build up and strengthen Germany's industries generally than the German tool builders can ever do, however well protected they may be or how prosperous they may become. He goes further, and applies the same principles to his own business of bolt and nut making, saying that it is obviously to the interest of Germany's industries and of her people generally to have good bolts and nuts at the lowest possible cost. He proposes, by keeping abreast of the times, to provide them, but when he is unable to do so he is willing that others shall supply them. This question of the proposed increase of tariff on machine tools imported into Germany is becoming a very live one. I have learned considerable about it, am learning more, and shall probably have something further to say about it, not as a politician, nor as a member of any political party, but simply as a citizen interested especially in the machinery industry and business of my own country. F. J. M.

Paris, June 22.

Flat Springs.

BY ROBERT A. BRUCE.

Flat springs, which owe their elasticity to their power of deflecting under bending stresses, should be and generally are avoided whenever it is possible to substitute for them helical springs in tension or compression. The comparative simplicity of the flat type of spring, however, enables it to be used profitably at times, notwithstanding its theoretical disadvantages.

The value of a spring depends upon the amount of energy which can be stored in or absorbed by it; consequently the relative values of different types may be defined and compared by evaluating the number of inch pounds of energy which one cubic inch or one pound weight of material converted into such springs can accumulate or store. This quantity is known as the resilience per cubic inch or pound of a spring. If a spring whose volume is V cubic inches can be loaded safely with W pounds, causing a deflection of δ inches, the stored energy is evidently $\frac{1}{2} W \delta$, and the resilience per cubic inch is $\frac{1}{2} \frac{W \delta}{V}$

In the case of helical springs subject to tension or compression and manufactured from wire of circular section, every section of the material is subject to a uniform torque, and the spring may be allowed to go on deflecting till the stress engendered by this twisting action reaches a limit depending upon the elastic strength of the material. On investigation it will be found that for circular sections the product of angular deflection and torque (half of which product gives the measure of the resilience) is constant for the same weight or volume of material and independent of the diameter and the length. It therefore becomes possible to predict the total weight or volume of a helical spring if the energy which is to be absorbed by it is known. Thus, a cubic inch of steel may be made into a round wire of $\frac{1}{8}$ inch diameter, 81.5 inches long, or into a wire $\frac{1}{2}$ inch in diameter and 5.092 inches long. Supposing, therefore, that the material can safely withstand a torsional stress of 50,000 pounds per square inch (an average value for good-tempered spring steel), the values of the torques which they can withstand will be, for $\frac{1}{8}$ inch in diameter, 19.175 pounds at 1 inch radius, and for $\frac{1}{2}$ inch diameter 1,227.2 pounds at 1 inch radius. Similarly for average material the angles through which one end would twist with respect to the other would be, in the case of the wire of $\frac{1}{8}$ inch diameter, 5.433 radians, and for the $\frac{1}{2}$-inch diameter wire, .0849 radians. It will now be found that for the $\frac{1}{8}$-inch wire, torque $\times$ angle of torsion $= 5.433 \times 19.175 = 104.2$. Similarly for the larger wire, torque $\times$ angle of torsion $= 1227.2 \times .0849 = 104.2$. Hence we see that the energy which one cubic inch of steel converted into springs of the helical type can store amounts to as much as 52 inch pounds per cubic inch, or, since a cubic inch weighs .28 pound, the resilience per pound is 186 inch pounds.

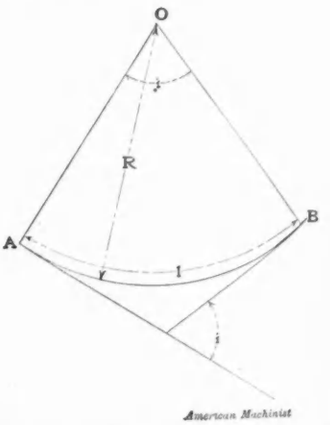
These figures apply only to circular sections, and for wire of square section employed in making helical compression or tension springs, inasmuch as the shearing stress is less usefully distributed over the section, the resilience per cubic inch and per pound falls respectively to 30.8 and 114 inch pounds.

Now, for springs subject to bending and of square or rectangular section the most favorable condition for resilience is that at every section throughout the length of the bar the extreme fibre stress is uniform and as high as the elastic qualities of the material will allow. In the case of bars of uniform section this condition can only obtain when the bending is uniform. Generally speaking, when springs are made of uniform section and loaded either as beams or cantilevers, the resilience falls to a third the value which could be obtained by disposing the material so as to be uniformly stressed. It is a well-known result that for bars of rectangular or square section, so shaped as to secure a uniform extreme fibre stress, the resilience per cubic inch is $\frac{f^2}{6E}$ where f is the maximum allowable fibre stress and E is Young's modulus of elasticity.*

Now, if we take for f, 60,000 pounds per square inch, and if E equals 30,000,000, we have for the resilience per cubic inch of steel springs which bend and are of uniform strength, 20 inch pounds, the resilience per pound being 71.5.

These figures are sufficient to justify the opening remark of the article, the resilience per pound of the best springs which bend being less than half that of the ordinary helical spring of round section, and only two-thirds of that of helical springs of square section. It becomes all the more important, therefore, when it is necessary to use such springs, that the design should be such as to secure the best economy of material. This is not difficult if it be remembered that in order to se-

*$A B$ represents a bar originally straight, but bent into part of a circle by being subjected to a uniform moment M. The section is supposed to be uniform, and the radius of the circle is $R = \frac{EI}{M}$ where I is the moment of inertia and is therefore equal to $\frac{1}{12} b d^3$ where b is the breadth, and d the depth of the bar, also $M = \frac{b d^2 f}{6}$ where f is the maximum stress. Now the resilience, $U = \frac{Mi}{2}$ where i is the angle between the



extremities of the beams. And from the small figure $i = \frac{l}{R} = \frac{lM}{EI}$

Hence $U = \frac{1}{2} Mi = \frac{1}{2} \frac{M^2 l}{EI}$

or $U = \frac{1}{2} \times \frac{b^2 d^4 f^2}{36} \times \frac{e}{E} \times \frac{12}{b d^3}$

$= (b d l) \times \frac{f^2}{6E} = \frac{V f^2}{6E}$

where V equals the volume of the bar.

Hence resilience per unit volume $= \frac{f^2}{6E}$

cure uniformity of stress, the shape of a flat spring should be that of a cantilever, or beam of uniform strength.

Referring to the table, it will be seen that the types of maximum strength are 1, 3, 6 and 8. Types 2, 4, 7 and 9 give practical approximations to the ideal forms. Figs. 5 and 10 are springs of uniform section. It will be readily seen that the types numbered 3 and 8 are perfectly practicable, but expensive to produce, the profile being parabolic. Types 4 and 9 are easily produced, but only 72.5 per cent. of the maximum resilience is obtainable. Shapes 1 and 6 are easily produced, but are impracticable on account of the sharp point; if the point is made blunt, as in types 2 and 7 (where the point has a breadth one-quarter that of the spring at its greatest breadth), the resilience rapidly falls off, the particular case shown only having 70 per cent. of the maximum resilience. Types 5 and 10 have only one-third of the maximum resilience, and there is consequently a great waste of material, which is, however, partly compensated for by the extreme simplicity of production. On the whole, the forms most likely to be generally useful are those numbered 2, 4, 7 and 9.

The table has been arranged with a view of enabling designers to settle the dimensions of a given spring with the minimum amount of trouble. In the first place, it is supposed that the length is settled beforehand by the exigencies of the design, and that the data at hand are the maximum deflection required and the load causing it. Under these circumstances it will be observed that the simplest method of proceeding is to first settle upon the proper depth t in order to secure the requisite deflection. The formula for this purpose is

$$t = a \times \frac{l^2}{\delta} \qquad (1)$$

in which

l = length,
δ = deflection,
t = thickness,

all in inches.

The value of the multiplier a depends upon the safe stress f and the modulus of elasticity multiplied by a number which varies according to the type of spring adopted. The general value of a is given for each type of spring in the column under the heading a, but inasmuch as a good all-round value for f is 60,000 and for E 30,000,000, a second column has been added, giving the numerical value of a for these values of the stress and modulus. They may be confidently used for general work, and in cases where springs are not subject to alternate bending in opposite directions. The thickness having been determined, the breadth in inches is next found by making use of the formula,

$$b = c \times \frac{Wl}{t^2} \qquad (2)$$

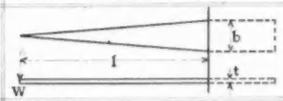
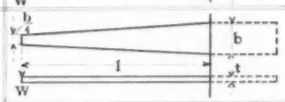
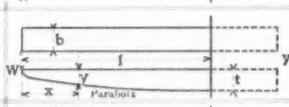
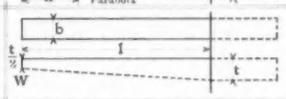
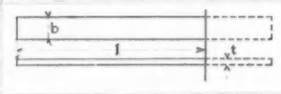
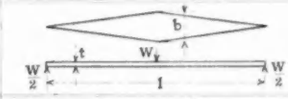
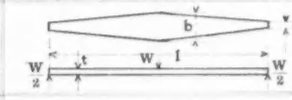
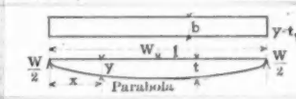
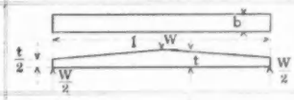
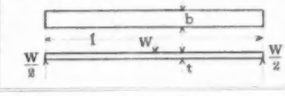
in which

W = maximum load in pounds,
t = depth in inches,
l = length in inches.

The value of c for the general case is given under the first column marked at the head c. For ordinary steel springs a second column of values of c has been added, the values assigned to f and E being the same as before. The principal dimensions of the spring are therefore easily settled. In order to find the cubic volume of the spring, multiply the product of l, b and t by the number given under the column marked v. A useful check on the work is to find the energy to be absorbed by the spring by multiplying the deflection by half the maximum load. If this quantity be divided by the number given under the heading R, the result should be equal to the volume of the spring in cubic inches. The first column lettered R gives the general value of the

SYMBOLS USED.

f – Safe Stress in pounds per square inch.
E – Modulus of Elasticity (pounds and inches).
R – Resilience or Energy in inch pounds per cubic inch.
W – Maximum Load on Spring in pounds.
δ – Maximum Deflection in inches.
l – Length of Spring in inches.
t – Thickness or Depth in inches – a $\times \frac{l^2}{\delta}$
b – Breadth in inches – c $\times \frac{Wl}{t^2}$
V – Cubic inches in (useful part of) Spring – v $\times$ lbt

	Type of Spring used	General a	General c	General R	General v	For f=60,000 E=30,000,000 a	For f=60,000 E=30,000,000 c	For f=60,000 E=30,000,000 R
1		$\frac{f}{E}$	$\frac{6}{f}$	$\frac{f^2}{6E}$	$\frac{1}{2}$	$\frac{2}{1000}$	$\frac{1}{10,000}$	20
2		$.87\frac{f}{E}$	$\frac{6}{f}$	$\frac{.70f^2}{6E}$	$\frac{5}{8}$	$\frac{1.75}{1000}$	$\frac{1}{10,000}$	14
3		$\frac{4}{3}\frac{f}{E}$	$\frac{6}{f}$	$\frac{f^2}{6E}$	$\frac{2}{3}$	$\frac{8}{3}\times\frac{1}{1000}$	$\frac{1}{10,000}$	20
4		$1.09\frac{f}{E}$	$\frac{6}{f}$	$\frac{.725f^2}{6E}$	$\frac{3}{4}$	$\frac{2.18}{1000}$	$\frac{1}{10,000}$	14.52
5		$\frac{2}{3}\frac{f}{E}$	$\frac{6}{f}$	$\frac{.33f^2}{6E}$	1	$\frac{4}{3}\times\frac{1}{1000}$	$\frac{1}{10,000}$	6.66
6		$\frac{f}{4E}$	$\frac{6}{4f}$	$\frac{f^2}{6E}$	$\frac{1}{2}$	$\frac{1}{2}\times\frac{1}{1000}$	$\frac{1}{40,000}$	20
7		$.87\frac{f^2}{4E}$	$\frac{6}{4f}$	$\frac{.70f^2}{6E}$	$\frac{5}{8}$	$\frac{7}{16}\times\frac{1}{1000}$	$\frac{1}{40,000}$	14
8		$\frac{1}{3}\frac{f}{E}$	$\frac{6}{4f}$	$\frac{f^2}{6E}$	$\frac{2}{3}$	$\frac{2}{3}\times\frac{1}{1000}$	$\frac{1}{40,000}$	20
9		$1.09\frac{f}{4E}$	$\frac{6}{4f}$	$\frac{.725f^2}{6E}$	$\frac{3}{4}$	$\frac{.54}{1000}$	$\frac{1}{40,000}$	14.52
10		$\frac{f}{6E}$	$\frac{6}{4f}$	$\frac{.33f^2}{6E}$	1	$\frac{1}{3}\times\frac{1}{1000}$	$\frac{1}{40,000}$	6.66

American Machinist

THE DESIGN OF FLAT SPRINGS.

resilience per cubic inch for a spring of a particular type, and the second gives the resilience when the stress is 60,000 pounds per square inch and the modulus of elasticity 30,000,000.

In using any spring of the types numbered 6 to 10 the supports of the spring must be so arranged that there is freedom to move inwards. The maximum load and deflection for a given load can be found by transposing formulas 1 and 2 as follows.

$$W = \frac{b t^2}{c l} \qquad (3)$$

$$\delta = a \times \frac{l^2}{t} \qquad (4)$$

New Brompton, England.

Standardization.*

Before entering upon the subject of Standardization I wish to preface my remarks by the statement that it was my good fortune to be associated with the founders of the American Society of Mechanical Engineers just twenty years ago, and it is a coincidence that I was granted then, as I have been now, the honor of reading the first paper before the society. As that society has gone on in extent and influence far beyond the fondest hopes of its founders (as it is hoped that this may also), let us consider why it has grown and what has been its best feature. It has grown because it was an honor and advantage to belong to it, and its best feature has been the influence association has had upon its members.

An incident that happened in its early history is one we can all take to ourselves, and it's worth relating: Mr. Holloway, one of the honored presidents of that society, had infringed, as men sometimes will, the patent of Mr. Worthington on his pump. During the trial and about the time the society was formed, if I remember correctly, the two men, both men among God's noblemen, became acquainted, and in conversation Mr. Worthington said to Mr. Holloway, "If I had known you, I should never have brought this suit." And Mr. Holloway replied, "If I had known you, I should never have infringed your patent." If we cultivate this spirit our society will succeed.

In looking forward to see what we can do in the way of standardizing, let us consider the history of the moves that have been made in that direction. Far back as I remember, the establishment of an agreement between the machine tool builders of Philadelphia (including the furnishing of shafting and pulleys) fixed upon the sizes of shafting as one-sixteenth less in diameter than merchants' round bar iron, calling the shafting size the same as the iron from which it was made—2-inch shafting being 1 15-16 inches, 2½-inch shafting 2 7-16 inches, etc., the advantage of a standard system showed itself at once.

Other makers of shafting and pulleys outside of Philadelphia were slow to adopt the standard, and in some cases, likely, with good reason. One-sixteenth inch allowed so little stock to remove that only those who had the best facilities could make a 2 7-16-inch shaft out of a 2½-inch bar, and so shafting continued to be made 2⅜ as well as 2 7-16 inches.

There is an additional advantage to the making things to standard size, and that is, the using of things of standard sizes. In the old days, shafting in mills and shops began large at the water wheel and tapered down as it went farther and farther away. This of course was theoretically correct, provided they based their calculations on correct factors, but experience, as pointed out by John Richards in his grand work on "Workshop Manipulation," showed that it is not the strains that can be foreseen and estimated that we have to consider, but the accidental ones; and, as the accidental strains are as likely to be at one place as another, having the shafts in a mill or shop all of one size is justifiable and a great convenience.

No one who cannot remember back to forty or fifty years ago, when the standardization was inaugurated, and also the introduction of parting pulleys, can realize the difference it has made in that one shop feature alone. In the adoption of the standard for shafting sizes the Philadelphia people made one mistake, as subsequent events proved, and that was in calling a shaft the same as the iron it was made from; for when the matter of cold-rolled shafting was introduced they made all sizes, and the man who ordered 4-inch shafting got 4-inch, instead of 3 15-16-inch, so the standard system went half to pieces.

The adoption of standard threads, a move more far-reaching than that of shafting, and that to which the manufacturers of the country owe a debt of gratitude to Philadelphia, is an object lesson that is hard to fully realize. In the place of bolts and nuts of all sizes, all sorts of pitches and threads of all shapes, we now can order screw and turret-head machine dies, that will cut practically standard threads and standard nuts, with fair prospects that the two can be made to go together.

In this establishment of the standard for threads, nuts and bolt heads, difficulties arose that never have been overcome. In the matter of standard pitch of threads, with one exception, there is a national agreement; the exception is in the ½-inch. The 13 to the inch is right and 12 to the inch wrong, and yet many continue to adhere to the 12. In the matter of the shape of the thread, the Sellers standard and the "V" are used. At the time, or for some years after the Franklin Institute or United States standard was adopted by the Philadelphia machine tool and engine builders and by the United States Government, the Morse Twist Drill Company, of New Bedford, were extensive, if not the most extensive, makers of taps and dies. In their circulars they listed both the 13 and 12 threads for the ½-inch size, showing both United States and "V" threads, and in a footnote made the statement that unless otherwise ordered, they furnished "V" threads; and in the discussion on the subject before the Society of Mechanical Engineers, the superintendent said that about 80 per cent. of their orders was for the "V" threads.

Some years later, when Pratt & Whitney went into the same business at great expense, they published a similar list, but with the statement that unless otherwise ordered, they furnished the United States standard, and they tell me, just what might have been expected, that about 80 per cent. of their orders are United States standard. The lesson to be learned from this is that there are a lot of people who are indifferent, but who will do the right thing when set at it in the right way. In this, as in the case of the shafting sizes, the Philadelphians made what would seem to have been a mistake in settling the sizes of the short diameters of the nuts and bolt heads, but not quite as bad as that of Whitworth, whose English standards were used as a sort of model upon which the Franklin Institute system was based. Whitworth adopted the following rule for the size of bolt heads and nuts, and that was that a hexagon nut should be twice the diameter of the bolt across the corners, which was an ideal one for the draftsman, but left the size across the flats (the very thing the machinist wanted to know) an undeterminable quantity, the square nuts to fit the same wrench as the hexagon. The Sellers sizes are based upon the well-known rule of once and a half the diameter of the bolt plus ⅛ inch for rough nuts and plus 1-16 inch for finished nuts; this because they intended to use the same blanks for both and give 1-16 inch for finish, the same as they had allowed for shafting. This made it necessary to supply thirty odd wrenches to fit the different sizes from ¼ inch to 2 inches, which the committee of government officers cut into when they adopted what has since been known as the United States standard, by making all nuts once and a half the diameter of the bolt plus ⅛ inch.

During the consideration of this subject before the Franklin Institute, the writer attempted to introduce a different notion, and that was, to ignore the size of the bolt entirely, but to agree on a standard set of wrenches, and those of standard sizes, such as ¾, ⅞, 1, 1⅛, 1¼, 1½ inches, etc., then make the nuts to fit the wrenches, eleven wrenches taking the place of thirty-two by the Sellers system or sixteen by the United States standard. If it became convenient to use a thin nut, use one size wrench; or a thick one, use a smaller one. The company with which the writer is connected follows this idea now to a certain extent. All bolts and cap screw heads

* A paper read by Prof. J. E. Sweet before the Engine Builders' Association of the U. S., April 28, 1900.

are made the size of a nut one size smaller —that is to say, the head of a ¾-inch bolt or cap screw is the size and thickness of a ⅝-inch nut, and in the case of double or check nuts, we make the outer nut one size smaller than the other. This makes a better looking job, and it takes a number less wrenches for a complete set for an engine; ⅝-inch wrench will hold the head of a ¾-inch bolt while the ¾-inch wrench is turning the nut.

What seems to the writer as one of the first problems that presents itself, is that we should strive to have brought to a standard the different features that enter into the question where the dynamo and the engine builder's work come together in our direct-connected plants. As it is now, there is no such thing as a compromise, but the engine builder makes all the changes necessary to fit every sort of dynamo that any dynamo builder sees fit to make.

There is one thing we ought to agree upon, at least, and that is, which we shall shall call a right-hand engine and which a left. Our practice is, when standing at the cylinder end of the engine and looking towards the wheels, to call the plant left hand when the dynamo is on the left hand. One way is as well as another when we all understand it alike, and there is no argument in favor of either, except that a dynamo that is left hand, as above described, would, when looked at from the commutator end, rotate opposite to the hands of a watch, or like a left-hand screw, and for that reason might properly be called left hand also.

To make any headway with the electric people, so as to enable us to avoid making a different sort of base for not only every size and every builder (which is not only a great expense for patterns, but for storeroom), we have to make it to the interest of the dynamo builders to make a change, and this can be done, I think, provided we can first agree among ourselves upon a standard, and this we ought to be able to do in some way, and then say to customers, "If you adopt a standard dynamo the price will be such a figure, but if some sort of a dynamo that we have to make a special base pattern for, then so much more"; thus the builder who makes standard machines will have an advantage over the builder who does not. At first they say to themselves, "It will cost us more to change patterns than we will lose on the sale"; but that will not last long, as changing patterns will have to be done but once, while they will be handicapped on every sale.

Even though the present builders refuse to change patterns to conform to a standard, if we have a standard agreed upon by ourselves that the shafts shall be of some fixed size, the field feet of a certain size and distance below the center, the dynamo within a fixed length, etc., every electric company new to the business will readily make their designs to meet the engine builder's patterns.

Details of what we shall endeavor to standardize in this direction is a subject that will have to be dealt with by your committee in connection with the committee of the dynamo builders and the committee from the American Society of Engineers, with whom they are in correspondence.

Just how many engine details it will be possible to standardize one with another, if any, is hard to even think of.

There is a peculiar streak of human nature which each generation seems to be born with, and it takes pretty nearly a lifetime to convince manufacturers of its folly. In England, before Whitworth fought out the battle of standard bolts and nuts, each maker of tools, machines or engines tried to adopt sizes, pitches, shapes, etc., different from every other builder, so as to secure the control of furnishing his own repairs. In this country when the mower and reaper business was being built up by hundreds of shops throughout the country, each one tried to have a different size and shape of section from every other, so as to be able to control the sale of repairs to his particular machine. It always cost him a lot, in two ways—all dies and fixtures had to be made special, and he had a lot of experimenting, often expensive, to find out whether the form would work or not, while there were at his hand tried forms; and as to securing control of extras, it amounted to nothing, for the knife maker could easily reproduce the form as soon as the demand made it worth while; besides, each overlooked the fact that if no other knife or section would fit his machine, his would fit no other, so even though he kept others from furnishing repairs to his machine, he lost the chance of doing the same to twenty others. In considering the possibility of standardizing engine parts, if that is possible, the same thought will come to every firm, with likely just as little reason.

The work of standardizing can only be accomplished where it can be made to pay, and then, for reason shown above, it is sometimes slow. In the case of freight cars everything standardized was of such self-evident advantage that the different roads and builders fell in line quite readily, and this has helped in other railroad matters, but with us the advantages can be only slight so far as engine parts go, beyond the connection with dynamos.

Adopting standard contracts, standard publications, and even standard sized catalogs will be some little advantage to all of us, for I fancy, in addition to the secretary having copies of our catalogs, each of us will have the others, and if all of a size, they can be all the easier kept together and at hand.

Since writing the above, it was my good fortune to meet with the chairman of the committee from the American Society of Mechanical Engineers, and the representatives of the two largest electric companies, in conference regarding the standardization of the dynamos, with a result very gratifying indeed. We not only found the dynamo builders willing to make almost any concession if it were in any way possible to agree upon standards, but they say that they feel that it is as much to their interest as ours, and I now feel sure that if we do not standardize the most of the sizes, and eliminate the odd sizes, it will be the engine builders' fault and not the dynamo builders'.

As a preliminary committee, we agreed upon the sizes and speeds which are within the range given by all the builders who responded, I believe; and the shaft diameters, making the shafts two sizes for center crank and side crank.

As there was no one present who builds the small engines, nor dynamo builders that make a specialty of small dynamos, nothing less than 25 kilowatts was considered.

The following were the sizes, speeds and shaft diameters that were reported to the Mechanical Engineers and Dynamo Builders at the meeting of the Mechanical Engineers at Cincinnati:

TABLE.

		Shafts.	
K. W.	Speed.	Center Crank.	Side Crank.
25	300 to 325	3⅝"	4½"
35	285 to 315	4	5½
50	260 to 290	4½	6½
75	250 to 280	5	7½
100	240 to 275	5½	8
150	200 to 225	6½	9
200	175 to 200	7½	10
250	150 to 175	9	12

While we may have to accept two styles of bases, I have no doubt but that they can be all brought to within the two styles, as it is proposed two sizes for the shafts. One style of base will be such as will fit the dynamo split vertically, such as the Westinghouse, Jenney, Triumph, etc., and the other to fit the General Electric, Crocker-Wheeler, Eddy, etc. The other dimensions for the field seats, hight below shaft centers, width between limit lines, etc., will have to be approached in the same way, and if in the same spirit, I believe there will be a standard agreed upon—not that all will conform to it (at least not at first), but when it is found that those who do conform to it can keep everything on hand, and so insure quick delivery, those who do not conform will soon find themselves out in the cold.

One may think, as he now has innumerable patterns that will fit everything, that he will have an advantage, but he will soon find it expensive to carry patterns and castings when the want of them will be a remote possibility. But the greatest encouragement of all is this: If we can only agree among ourselves, the dynamo builders will be glad of it.

FIG. I. THE CORE.

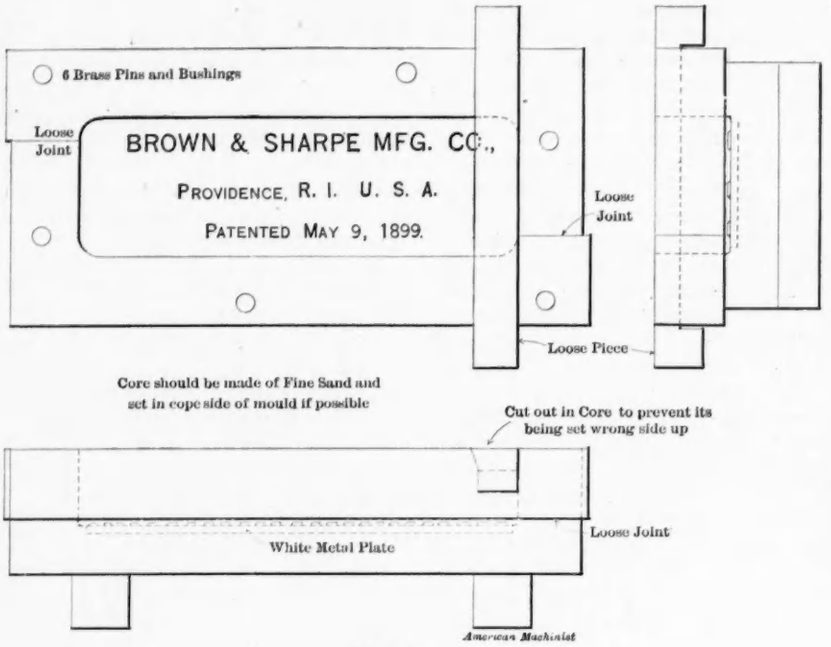

6 Brass Pins and Bushings
Loose Joint
BROWN & SHARPE MFG. CO.,
PROVIDENCE, R. I. U. S. A.
PATENTED MAY 9, 1899.
Loose Joint
Loose Piece
Core should be made of Fine Sand and set in cope side of mould if possible
Cut out in Core to prevent its being set wrong side up
White Metal Plate
Loose Joint
American Machinist

Fig. 2

CORE BOX FOR NAME CORE.

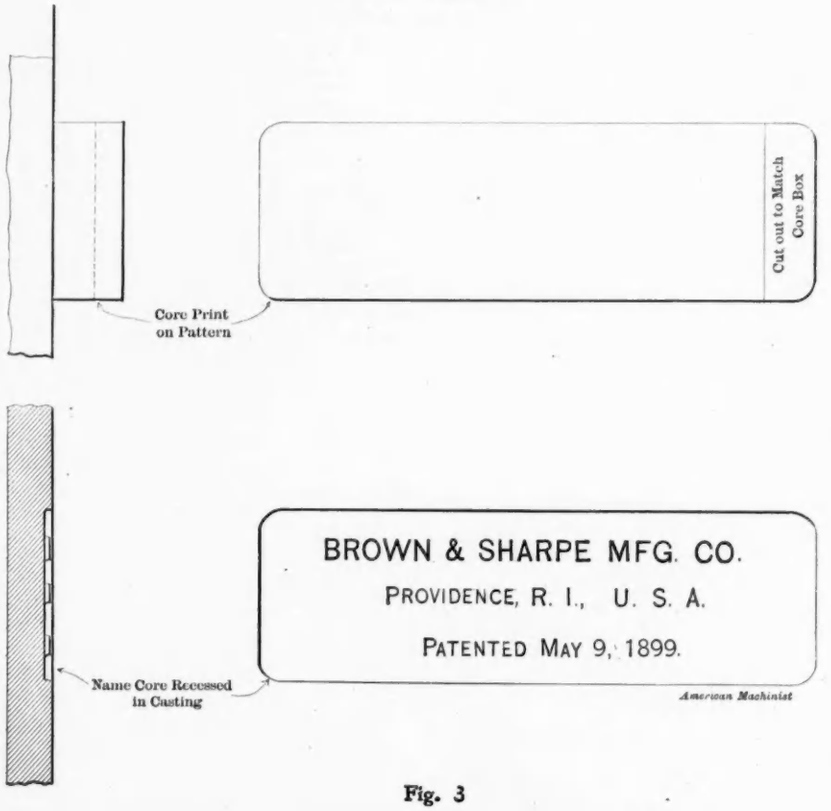

Cut out to Match Core Box
Core Print on Pattern
BROWN & SHARPE MFG. CO.
PROVIDENCE, R. I., U. S. A.
PATENTED MAY 9, 1899.
Name Core Recessed in Casting
American Machinist

Fig. 3

SKETCH SHOWING CORE PRINT AND THE INSET OF THE NAME PLATE.

Making Name Plates on Castings.

A machine for the market should not only be all right, but it should also recommend itself by looking all right in every detail, and a neat and effective name-plate is a selling feature not to be despised. We recently received from a subscriber a letter of inquiry as to the casting of name-plates on the bases, frames or other principal castings of machines. The writer expressed admiration for the lettering upon the machines built by the Brown & Sharpe Manufacturing Company, and confessed that he had tried to imitate and equal the same, without success. We ventured to address a letter of inquiry to Messrs. Brown & Sharpe on the subject, at the same time suggesting that it was not improbable that our inquirer was an active competitor. A courteous reply from Mr. R. Viall, superintendent for Brown & Sharpe, enables us to lay before our readers the following information upon this interesting topic.

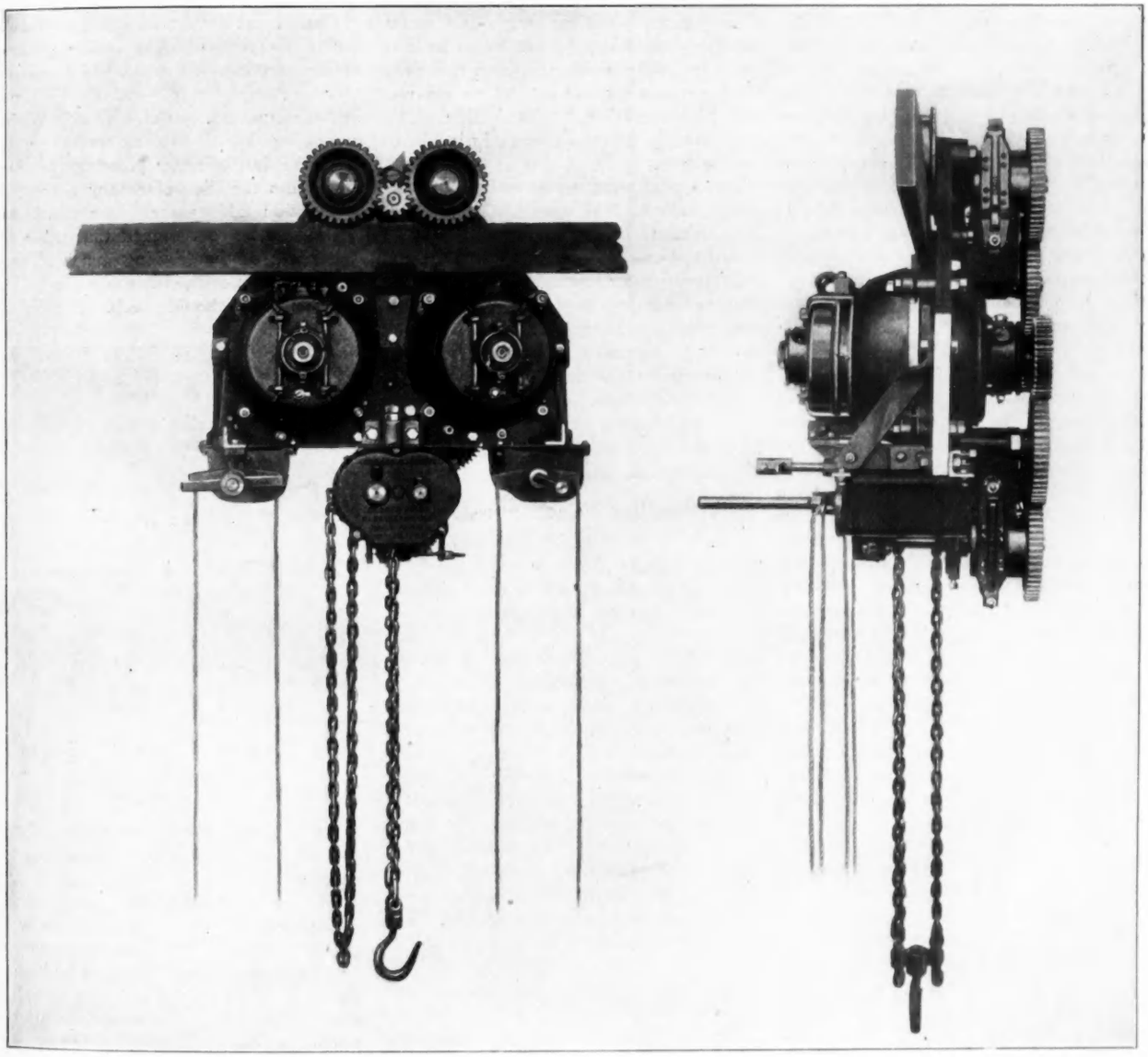
It will be seen that the lettering is done by a core, which is self-evidently a double advantage, as one core box will serve for many different castings, and as the core may be made of finer material more carefully manipulated and produce a finer and sharper impression than would probably be secured by the usual process of molding with the letters upon the pattern.

Fig. 1 shows a core, which unfortunately was broken in transmission, so that the half-tone is offered with a slight apology. Fig. 2 is a sketch of the core box, and Fig. 3 shows the pattern with projecting core-print, and, in section, the inset of the name-plate. The projecting thickness of the core-print is less than the thickness of the core, so that when the core is in position in the mold the face of it is within or below the normal surface of the casting, but not so low as to sink the faces of the letters below the casting surface. These preferably project slightly, so that, if desired they may be ground or otherwise faced. The core, it will be noticed, has a thinner portion on one end, with a corresponding shape provided on the core-print. This prevents setting the core the wrong way and inverting the letters.

An important condition of success is the mixture for the cores. They should be made of fine sand and mixed with oil called "Core Compound," the preferred brand being that of the Cleveland Core Compound Company. The sand that is put next to the letters in the core should be mixed with that. The back filling can be made of common core mixture; if it is a coarser grade it will do no harm, but that which makes the letters must be fine, and while it can be made without the core compound, it is much better with it, as the iron lies to the letters better than it does to the ordinary mixture of flour. Even this system will not produce good results unless carefully carried out according to instructions, and of course experience counts for much.

Electric Trolley Hoist.

The accompanying illustrations show two views of a new electric trolley hoist made by the Sprague Electric Company, of this city. The side view, Fig. 1, shows a symmetrical frame, with two Lundell enclosed motors of one horse-power each, one of which is connected by gearing to the hoisting mechanism below, while the other connects in a similar way to the traversing wheels above.



AN ELECTRIC TROLLEY HOIST.

Both the hoisting and traversing gear are provided with electro mechanical brakes, which are automatically released when the motors are put in operation, and applied when power is cut off. The control of the motors is obtained through the pendant chains or cords, there being one cord for each direction of motion on the two respective motors. The controls are entirely enclosed, and are arranged so that they may be provided with automatic limit cut-offs, which shut off the power when the limits of motion have been reached. The machine may have a capacity of 500 or 800 pounds, as desired, the speed of hoisting the smaller load being one foot per second, with a corresponding reduction for the heavier load. Power is taken to the hoist through trolley wires in the ordinary fashion of traveling cranes. The end view, Fig. 2, shows the manner of suspending the hoist from the track, as well as the arrangement of the gearing. To give quietness of operation the pinions are of rawhide.

The Draftsman, the Pattern Maker and the Molder.

BY L. C. JEWETT.

Some remarks have been made recently in the columns of the "American Machinist" upon the necessity of the drafting room keeping in close touch with the pattern shop. This is not enough. Both the draftsman and the pattern maker should be urged to keep as close in touch as possible with the foundry department. Stray in there often, both of you, and look out particularly when a new or important pattern is to be drawn out of the sand, a mold to be stopped off, lengthened, enlarged in any way, cores to be set and filled over. Get familiar with the resources of the foundryman. See why this sometimes comes thus, and so on. Certainly the time would not be wasted and would be conducive to the mutual respect of the trio for each other.

As an illustration of the need of better acquaintance, not long since a number of castings were required from each of several patterns, duplicates except as to length, as per sketch, Fig. 1. They were not exactly like that, but the sketch will

illustrate the method used to mold them in the simplest way and with the cheapest rigging possible. The sketch represents the pattern as sent into the foundry from the company's pattern shop. Business was booming, never was better, and it was desirable to mold them quickly and save them all if possible. The foundry foreman had given considerable thought as to how to mold them and get portion marked *B*, Fig. 1, clean and sound, as that side was to be finished and polished.

The nubs *C C C C*, Fig. 1, precluded molding with side *B* of the pattern down in the nowel. The pattern was well made, in fact, a work of art, with every part intact, firm and solid. Loose parts to patterns were tabooed with that concern, as a rule. It was finally decided to mold it in a three-parted flask, cheeks to be drawn sideways from the pattern, thus casting *B* portions upright, a slow method in the molding, with great danger of failure, and while many were thus made, they were certainly unprofitable, besides coming slow.

Business increased with such pressure that a few of the patterns were sent to a neighboring jobbing foundry, where every drop of essence is supposed to be extracted from the almighty dollar, no matter where or how used. Of course, a new flask had to be built, and "what can we use it for when the job is out?" became a serious question, as well as the first cost of the flask. To have the cheeks roll off upon hinges was first considered, but owing to the undercut curve on the *B* side (see Fig. 4) it was seen that that would not do. Besides, three-parted flasks are expensive, and if cut up in shorter flasks there is liable to be more or less waste. Every day or so the proprietor and the foreman would meet in solemn conclave. Each would scratch his head over this vexed question without definite decision, and then they would adjourn *sine die*.

Finally the foundry foreman thought of a simple way to mold this pattern and in a two-parted flask, with *B* portion down when cast, with very little expense for alterations, while it insured for the *B* side absolute cleanliness. He thus explained his idea: The indentations at *D* to be cored out. Have a loose core print with removable pins, to be withdrawn when the cope is rammed sufficiently high to keep the print in place. Remove the projecting nubs *C C C C*, Fig. 1, leaving that side perfectly smooth. Make a template, Fig. 2, that will fit nicely into the mold where the legs with the nubs *C C C C* come, having holes through the template exactly corresponding, as to size and position, with nubs *C C C C;* then with the plug, Fig. 3, pushed through the holes in the template, imprints of the nubs *C C C C* can be made upon the side of the leg.

This method will divide by two the cost of the flask, requiring a two-parted instead of a three-parted flask, besides its being available for other jobs. It will take but one-half the time to mold it that would be consumed if made in a three-parted flask, besides being 100 per cent. safer. By this method the pattern is rammed up in a nowel lying in a good solid mold board. When the nowel is rammed and the bottom board on and clamped, turn the nowel over. Remove the mold board and ram up the cope; when rammed lift it off, turn it on its back, draw out the pattern, insert the template, Fig. 2, push in the plug, Fig. 3, draw out the print at *D*, set that and the two end cores, call up help, close on the cope, build up pouring heads, put on clamps, and "there you are," with *B* side to be cast down in the nowel, see Fig. 5, ready for the iron.

The change was made and proved an entire success. The nubs *C C C C* were quite small, being but ⅜ inch square by ½ inch deep—too small to allow of two pins to prevent their changing of positions while ramming up the cope. A thin metal plate could have been used with the nubs *C C C C* upon it, said plate to be loose and incorporated in the leg of the pattern, as per dotted lines, Fig. 1, but for economy and absolute certainty the template with plug is to be preferred.

A Bending Punch and Die.

I have in this article attempted to describe a type of die involving a principle that is extremely useful in the rapid production of work in the press room. It consists of bending the material by pressing it down into the bottom of the die and immediately closing it in on the sides of the punch, which usually corresponds with the inside shape and measurements of the work.

Referring to the illustrations, Figs. 1, 2 and 3 show pieces that we have produced by dies of this kind, and the work turned out is uniform in size and shape. Fig. 1 is the article formed from 1-16 inch thick by 5-16 inch wide hard brass by the punch and die here shown and described. The plan of construction has been adopted by us, as far as possible, as giving the best results after several trials with different devices.

Fig. 4 is a plan and end elevation of the die and a longitudinal section of both punch and die. *A* is a cast-iron die bed, carrying the slides *B*, which are held down by strips of ¼-inch steel screwed to the top of the die bed. *C C* are grooves planed in the tops of the slides to gage the work sideways. *D* represents pins for ends. *E* are pins that fit into the bottom of the die bed and limit the outward movement of the slides, which are grooved to permit them to slide the necessary distance. The slides are forced apart when the punch ascends by the coil springs *F*. The pins *G* pass down through the slides into the grooves and engage with the springs. The sectional view shows the method of construction. At *H* are lugs with ends turned and fitted to holder *I* and located by taper pins *J*. *K* is the lower or forming end of the punch, dovetailed to upper part *L*, which is machined to slide in a reamed hole in holder, being retained in position by pin *M*. The upper end of the stem at *N* on the punch holder is slotted to allow the punch to slide when in operation. Springs *O* hold the punch *K* down in proper position until the first bend is made.

The springs *O* vary as to size and number in proportion to the power required to perform the first bend. If necessary, they can be arranged around the punch in large numbers. In all dies of this kind the springs must be strong enough to perform the first bend by pressing the work down into the die before any perceptible contraction takes place. The punch and die should be so designed that when the lower end of the forming punch *K* rests on the bottom of the die the angles on the sides and lugs should touch. Further descent of the press will cause the slides in the die to be forced in and perform the side bends.

FIG. 1.

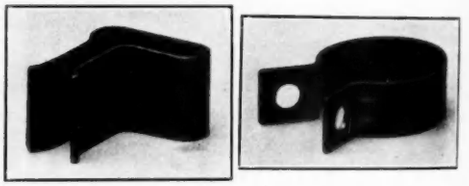


FIG. 2 FIG. 3.

THE PIECES TO BE MADE.

The parts of both punch and die will differ according to the nature of the work to be produced. When the piece formed has the same style of bend on both sides the angle of the slides and lugs should be about 45 degrees. For irregular work the angle on one side can be different from that on the other, thus causing one slide to travel a greater distance than the opposite one. An example of irregular bending is shown in Fig. 2. We have dies with three and four slides built on this plan in successful operation. DIE MAKER.

Lynn, Mass.

Belleville Boilers.

BY W. H. BOOTH.

I am interested in Mr. W. H. Harrison's letter of comment on this subject in the "American Machinist," No. 21, but he makes several misstatements which require correction.

In the first place, Mr. Harrison evi-

dently reads the wrong paper. Had he read the "Electrical Review," for example, he would have found that, from the first and right through all the official bolstering up of the Belleville boiler, that journal has never ceased to condemn the Belleville boiler and the folly of the huge experiment made with it. I do not profess to be more than a very ordinary expert in steam boilers, but a blueprint would be sufficient for me to refuse to have anything to do with such a boiler. I pointed out more especially the flat inclination of the tubes because this flatness would condemn any water-tube boiler, even without the enormous length of tube—some 90 feet—that adds so seriously to the other faults.

Mr. Harrison is further mistaken when he thinks England went mad over the Belleville boiler. I admit the craziness of the officials responsible for it, but can Mr. Harrison point to a single official of any English boiler inspection society or boiler insurance company who had a good opinion at any time of the Belleville boiler? I know a good deal of English boiler inspection, and I know no one of experience who has much of an opinion of any water-tube boiler, though I think most of us consider the Belleville to be the very worst of the lot.

I don't know how or why the Belleville boiler, with its French rattletrap devices, came to get in here as it has done. No boiler expert, as I have said above, thinks it any good, and most of us think it incurably bad. Apart from its dangers, due to its unnatural design, it is exceedingly wasteful of fuel; it is practically as heavy as the old shell boilers, and it is very short lived. It does not require much calculation to ascertain the volume of steam that must be produced in each tube of a water-tube boiler, and having done so, to find out how many times per hour the water in the boiler must circulate through and through the tubes in order that a given bulk of the tube space, be it half, or a third, or what not, shall be occupied by steam and how much by water. There are water-tube boilers in which, very probably, the arrangement of the tubes is such and their diameter is so small that each tube is filled by a succession of plugs of steam and water, following each other in very rapid succession, or it may be there is simply a rapid flow of mixed steam and water. Such boilers, if the water is clean, are not necessarily wet steamers; though it would appear good practice to direct the tube discharge through a mesh of wire cloth to assist the separation of the steam.

The trouble with water-tube boilers is, however, that they have no facilities for perfect combustion. In the first place, the products of combustion rise straight up from the fire grate among the cold tubes. I am told and I read about the perfect combustion of water-tube boilers, just as from time to time I read of new inventions of what I am old enough to see at once are simply perpetual motions. I take no more notice of these boiler claims than I do of the perpetual motion cranks. Whenever bituminous coal is burned so that the gases rise straight up among water tubes I know there will be smoke, and I don't mind being called stupid because I cannot be convinced to the contrary.

There was at least one staunch upholder of water-tube boilers who went so far as to claim that effluent gases were several degrees colder than the steam produced by the boiler. Water-tube faddists have claimed the impossible, but most of them have been men without any real boiler experience. In America, where there is so much anthracite coal that no one could make smoke, anything will do for a boiler. All one need consider is to cool the gases

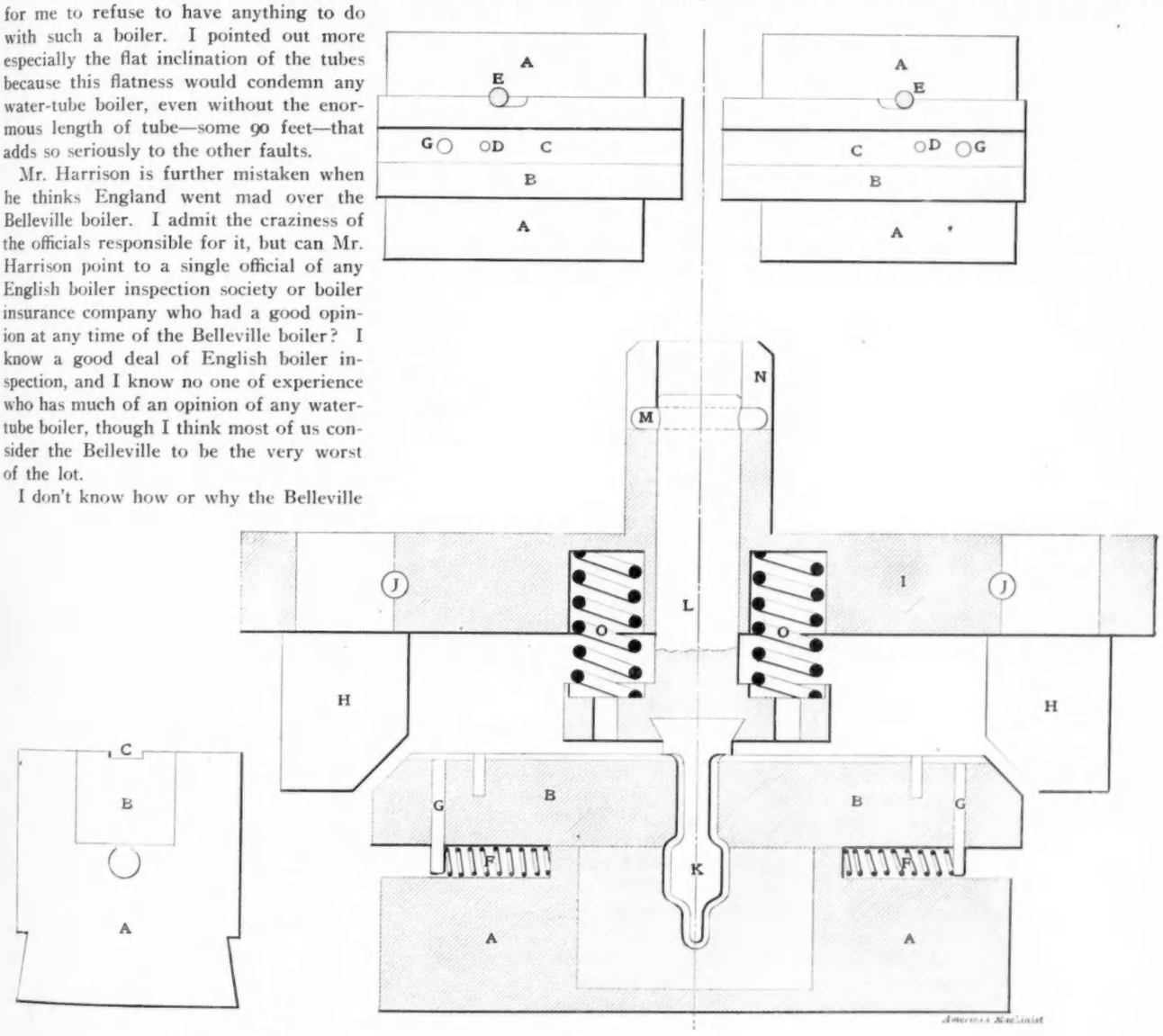


Fig. 4

BENDING PUNCH AND DIE.

down when they have fairly left the fire. But the water-tube boiler will smoke even with some of the so-called Welsh smokeless coals. The essentials to smokelessness have long been known for bituminous fuels. The first essential is that the whole products of the furnace shall sweep over the fire surface towards the bridge end with a sufficiency of fresh air admitted above the fire and usually through the perforated door. This mixes the gas and air and keeps up its temperature, and combustion is perfected behind the bridge, if there is provided there a sufficient uninterrupted space in which it can burn. Even with these factors present, the temperature of the mixed gases must be good, and the draft must be at least half an inch of water. There is only one thing now remaining that militates against success, and this is the cold envelope round the gases. In a Lancashire, or in a Cornish or Scotch boiler, there is a cold semi-cylinder round the fire and combustion chamber. In an ordinary cylinder boiler, externally fired, the roof over the fire is cold, but the side walls are of hot brick. In the locomotive boiler the brick arch exercises a saving influence upon the gases. In the water-tube boiler there are, it is true, brick sides to the furnace, but the roof is of cold tube, and if it were not the first essentials are entirely absent.

It is only fair to state that, as a result of criticism by myself and others and the boiler inspection people, there is one firm of makers of water-tube boilers which has realized the hopelessness of going on in the old way, expecting to secure smokelessness in direct opposition to nature. They raised their boiler and put in another row of tubes some way below the lowest ordinary row. The space between the tubes they blocked with fireclay tiles, so as to form a partially refractory roof above the fire. The tiles extended some way back and compelled the gases and fresh air all to flow to the bridge. There they rose to the combustion space and found themselves again under a fire tile roof formed on the lower row of ordinary tubes and above the previously named fire tiled tubes. This formed what was called a Scotch furnace, and it has proved fairly efficient, or would do so if they would admit the fresh air in fine streams, and not in a solid block. Smokelessness is so much a question of the ignition temperature of the gases that its accomplishment is very difficult in all water-cooled furnaces, and all ordinary forms of water-tube boilers are hopeless smokers.

London.

The Central London deep tunnel railway was opened June 27. The total length is 5¾ miles, and the total cost over three million pounds sterling. The line is electrically driven, and the entire motive-power outfit—engines, generators, converters, locomotives and elevators—is of American make.

Letters from Practical Men

Processes of a Typewriter Factory.

Editor American Machinist:

Five of your "American Machinist" readers, right here on this floor, protest against the article headed "A Typewriter factory." "Good!" cried one of the victims. "They are coming our way with an article on *typewriters.*" All turned to page 607, and there appeared an article on typewheels. Mr. Clegg says that instead of hydraulic pressure, the inventor uses steam. Further on he says: "A little water is then placed in the mold, the mold heated to temperature to turn the water into steam, thus forcing the composition into all crevices in the mold." Now, Mr. Clegg, they have one on you. You have written them up nicely, but they have imposed on you, we are afraid, for the wheel turned out by steam from a little water only will be a poor one indeed. Pretty well all through your article, apparently, you have been "codded." In one part of your article you say, in reference to the hole for the turning pin or dog: "To apply high-pressure steam directly to the interior of the mold from boiler." Try it, man. Further on you say: "On a movable bench in the center of Fig. 2 are seen several molds clamped in position." We found that on this bench lay several cylinders wherein possibly were some of the clamped molds.

Now, Mr. Editor, what we readers protest against is this: Apparently this article is written with the same earnest candor in which some of your other articles are written, with the purpose that some information will come to the reader; but allow me to say that for the many years that I have read the "American Machinist" there has never appeared an article lacking so much in this particular as this one; in fact, my colleagues say the article is intentionally misleading.

JOHN G. NIEDERER.

Editor American Machinist:

I am indebted to you for the opportunity to comment upon the letter of your correspondent. I have been a reader of the "American Machinist" from its second year, have taken a great interest in its progress, and occasionally have contributed to its columns with exactly that pleasure that one enjoys when writing to a personal and very helpful friend. It would therefore be a source of keen regret were I convinced that I had misled my fellow readers of the "American Machinist."

Of course we are all liable to error; and in the description of a process but little known, outside the factory mentioned in my article, one may easily be inaccurate.

Lest I might have failed to do the subject justice, I at once wrote to the gentleman who invented the process in use by the Blickensderfer Manufacturing Company for the manufacture of typewheels, and his reply thoroughly endorses the statements made by me in your columns relative to this matter.

I am by no means sure that anything can be said that will change the views of such an assertive critic as your correspondent; and, indeed, it is an issue of fact in which I am just as certain that my statements are correct as he appears confident that they are not.

There are, it is true, a number of noteworthy features about the Blickensderfer machine that could have been dwelt upon at some length; I selected the typewheel as deserving the greater share of attention, and the results have justified my choice. I had intended to return to the subject when time permitted, and then could compare the several highly ingenious devices wrought out by some of the inventors of wheel machines, and I trust that I shall do what little I can in this way purely and simply as a mechanic, and not as a partisan.

Let me add most emphatically that my admiration and interest are not confined to the wheel class of typewriters, and I should prefer to let the respective salesmen argue the relative merits and demerits of the two classes. Both can do excellent work; each has a ready sale, etc., and the purchaser, as a rule, cares more for the work done by the machine and its cost (the latter principally) than the mechanical means whereby these results are obtained. I am most concerned with the last item, and have a warm regard for that branch of industry that has demanded so many good mechanics to meet its needs.

R. I. CLEGG.

[The letter of Mr. Blickensderfer to Mr. Clegg, which at this writing we have in our possession, fully sustains and endorses Mr. Clegg's original account as correct. The secret of the whole matter is perhaps sufficiently contained in the following sentence from Mr. Blickensderfer's letter: "The manufacture of these wheels has cost us a great deal of experimental work, money and time, and anybody who attempts to do it, even after knowing the process, will find that he will have to spend thousands of dollars before he can turn out a perfect wheel." It is not an unheard of thing among mechanics for one to be declaring that impossible which another is actually accomplishing.—Ed.]

A Standing Drawing Board.

Editor American Machinist:

I send you a sketch of a standing drawing board of a very cheap and simple construction, which I have for home use. I am so well pleased with it that it occurred to me that someone else might like to use the same thing, provided it were called to their attention. My board is 6x4 feet, and when standing at an angle of 30 degrees from a vertical plane the lower edge is 24 inches from the floor.

The straight-edge is carried by two

drums detailed in Fig. 1. These drums are keyed to a 5-16-inch shaft running the full length of the board. At midway of the shaft is another drum of the same diameter, which is wrapped in the opposite direction, and to which is attached the counterweight which balances the straight-edge. The carrier cords are of braided linen, and are simply laced to the straight-edge, as shown in the sketch. Each of the little holes shown at the ends of the straight-edge has in it a brass bushing, rounded at the ends, to make the cord run through easily. At each end of the straight-edge is a cleat ⅜ inch thick, lapping the ends of the board, to prevent any side movement.

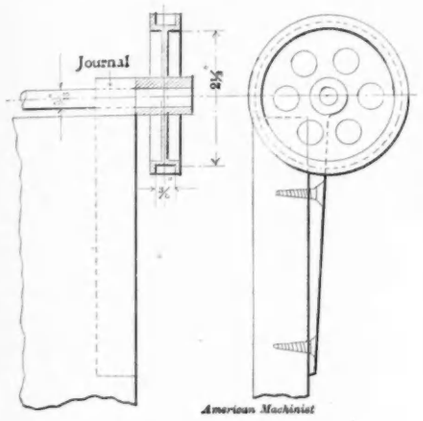


Fig. 1

SHEAVE ARRANGEMENT FOR STANDING DRAWING BOARD.

BAXTER ASLAKSON.

A Shaft Centering Rig.

Editor American Machinist:

I beg to send you a drawing showing how we center our crank shafts, connecting rods, etc. The machine is composed of a long bed *A*, on which are two movable supports *B B*, each equipped with a set of wheels on which the piece to be centered is placed. The distance between the supports is about half the length of the piece. With the help of a surface gage the workman makes four lines, turning the shaft a quarter turn each time, after which the center is easily found. On the bed *A* are also two cast-iron standards *C C* for the suspension of a pneumatic drill, which drills and countersinks the center holes and also faces the end of the shaft around the holes.

A. BOLLINCKX.

Brussels, Belgium.

Echoes from the Oil Country—II.

Editor American Machinist:

Before I had time to view the rest of the place or size up the men Mr. Smith announced his readiness to take me to supper. I found my future quarters at a farmhouse on the hillside. The low, unpainted house did not look inviting, but the spring of pure, cold water at one side made up for a great many other things.

I found board and a room 8x10 feet would cost me $5 per week. The room looked hardly large enough for a superintendent, but as my ideas of the importance of that position in this case had also shrunk some since my arrival, I thought it might do for a while. Wouldn't I clean up that shop though, and have a place for finished work and racks for tools and a place for dirty waste, and get the floor swept at least twice a week, and get some standards for sizes and make a little system and order? I would try to let Mr. Smith see how a shop should be run. Here was virgin soil for a system; no need to uproot a poor one, as there didn't appear to be any, so I had clear sailing.

After supper I had a very nice talk with Mr. Smith, and found he had large interests in the surrounding country, and that the shop was started from necessity to do his own repairs, and as his neighbors also wanted theirs done and he was of an accommodating turn he did theirs too—for a cash consideration—and bought and sold machinery and old iron of every sort.

He wanted me to do the head work, he said; to go out and look over a job and give an estimate as to the time necessary to do it and the cost, and plan a way; to keep the books, and in his absence to buy and sell; to make sketches of any idea we wished to keep track of, and when a man brought in an idea that was to upset the universe to put it on paper before doing any other work on it, so as to save argument between the owner of the idea and the machinist; to keep track of the stock; hire and fire the men as occasion demanded; inspect the work; design any missing part needed to complete anything we were repairing; furnish exact information on all subjects, and when not busy otherwise to turn in and help get out some work.

While having a general supervision of the foundry and blacksmith shop, I found they each had a leading man, as did the machine shop. Rattling good fellows, Mr. Smith assured me; hard workers, up to all the wrinkles on regular work, but not much good to figure out anything they were not used to; but I could depend on them as far as they went. I began to wonder just what kind of a cross I was intended to be, but as I was in for it I said little except that it might take me some time to get acquainted with the shop and the work, but I hoped soon to have things in better shape than they were.

I went with him and Billy, the second man, the next morning to repair an engine running on a lease. When we got there we found the engine (a 9x12) run-

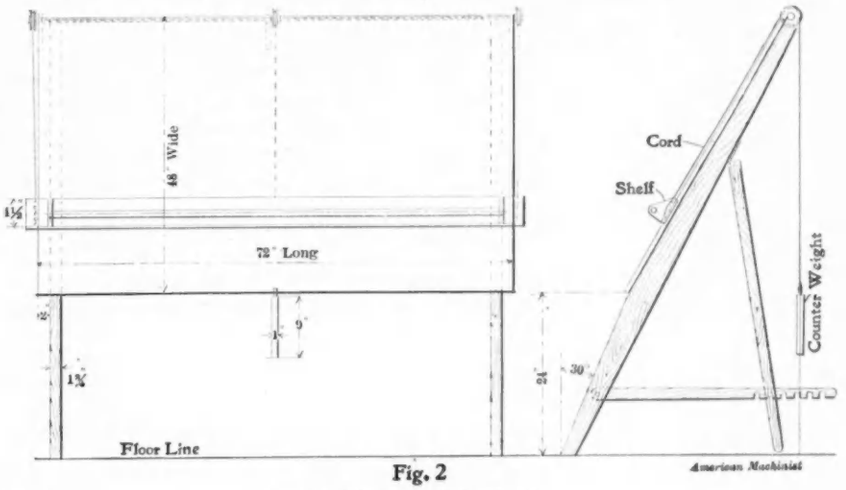
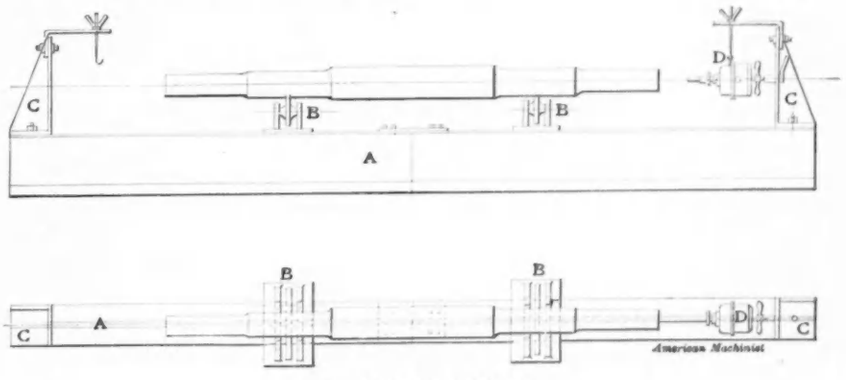


Fig. 2

A STANDING DRAWING BOARD.



RIG FOR CENTERING SHAFTS.

ning, and that they ran it continuously day and night, and as the wells were hurt by standing, it was desirable to not stop any longer than necessary.

We looked things over and found the main bearings and crosshead needed babbitting, the brasses needed shimming up, eccentric straps taken up, lost motion taken out of link, valve set, piston rings set out, and a few minor details looked after.

Mr. Smith asked me: "How long will it take to fix her?" I replied, "About fourteen hours for us three." Smith laughed. The pumper asked, "How long will I have to stand still?" "About four hours," said Smith. I smiled and thought Smith quite a joker in his way.

It was then 8 o'clock A. M. We had brought a few tools, a pot and ladle and some babbitt with us. In a very few minutes the belt was off, the key out of pulley (and more of these keys by and by) and the pulley off, the rod and crosshead and pillow block caps off, and with the help of a piece of plank under the flywheel the crank shaft was rolled out of its bearings and the babbitt knocked out.

Two pieces of lead about 2 inches long and ½ inch square were pounded out and bent to the shaft and one piece laid in the bottom of each box. The shaft was next rolled into place, with the flywheel on the plank, which could be raised or lowered with a chunk of wood under one end. A piece of board about 4 feet long was laid across the guides and held by the studs (Mr. Smith squinted down one side of the board and said he guessed it was straight enough). This was squared to the guides on the straight side with a carpenter's square; the shaft was let down carefully on to the lead, the plank holding most of the load. Billy fished a 25-cent level about 3 inches long out of his pocket and laid it on one bearing, reversed the level and tried again; tried the other bearing the same way.

Smith took a lath and drove a nail through one end so it stuck through about ½ inch, put the nail in the center of the snaft and let the other end lie across the board on the guides, moved it back and forth a little, and put a mark with his knife where the straight side of the board came; tried the other side the same way. "This side is ⅛ inch too long," said Smith; "and 3-32 inch too high," said Billy. A rap with a block in the right direction set the shaft back into the lead, and a second trial was made, which showed things closer. Two more raps and tries and a test of the board on the guides with the square and the setting was pronounced O. K.

The bottom of a shoe box made two pieces cut to fit one-half round the shaft and about ¾ inch wide, one of which was placed on the outer end of each pillow block and held in place with clay from the road. A strip of pasteboard from the same box filled up the crack on the lower side of the box (the bearings were set on an angle), while another strip was laid on top. Midway in the top strips openings were cut next to the shaft, about ⅜ inch wide by ¾ inch long, and about ½ inch from each end a small nick was cut, into which was put a small sliver of wood, then these strips were carefully "mudded" down, and a gate built around the center holes. The slivers were pulled out and we were ready to pour.

The babbitt in the meantime had been heating under the boiler in the gas fire, and was found to be just right—would just char a stick nicely, but not set it on fire. It ran in fine and even—came up in the holes where the slivers had been. A keen chisel nicked the runners so they broke off close down. Three more thicknesses of pasteboard at each place made liners enough. The caps were put on, and the same semicircles at the ends served for them, but here the slivers were laid between them and the caps and they were pressed down hard on each side of the slivers before "mudding up." Each cap had a hole, tapped for ½-inch pipe. Billy twisted a piece of pasteboard around his finger, cut a couple of pieces about as large as his thumbnail out of one end, stuck that end down to the shaft, cut the piece off even with the outside of cap, and repeated the operation with the other box, built up a gate around each hole, pulled out the slivers and was ready to pour, and got two more good runs; knocked off the gates and took off the caps. A couple of blows with a hammer and cape chisel cut the babbitt loose where the pasteboard did not touch the shaft, and an old bolt made a good punch to drive the pieces out of the oil holes. Pulling the pasteboard out left the threads clean and undamaged.

After cutting oil grooves in the babbitt, the liners were removed, the caps replaced and screwed down tight, the caps and shaft were struck repeatedly with a block and the flywheel used to turn the shaft in the bearings. The liners were then replaced with several additional thicknesses of paper to each cap and adjusted to allow the shaft to revolve—no filing or scraping.

The crosshead was then put in place with a couple of pieces of lead under it. It was placed as near the crank as possible, and tried sideways with calipers and guessed at for level by trying the little level, first on the guides and then on the rod, the rod, of course, being in the crosshead. Then followed more pasteboard and more mud and a good run. A little dressing sideways and grooves across the top and bottom put it in good shape.

Billy trued up the crosshead pin a little before putting it in for good, using a hammer and chisel and file, top and bottom, and several pieces of tank hoop made good shims for the connecting rod.

Taking out a piece of pasteboard fixed the eccentric straps, and three pieces of tin bushed the link pins.

The piston head was the old three-ring packing style, and was soon set out; but the pumper had to go to the house to get a flour sack to pack the cylinder head and steam chest cover.

Setting the valve consisted of pulling her over in the way she run until as near on the center as the eye could see, setting the valve there, then trying for the other end; move as necessary and try again. When satisfied, pull up the link and try with the other eccentric, always taking care to pull in the direction the engine was to run and to not overpull by the center, or, if you did, to come away back and come up again—never turn back a little to get her just right—too much slack for that.

Putting on the pulley and belt completed the job, and steam was on and the wells going at 11.45 A. M., and I hadn't done much except to get in the way and get dirty, except when I stepped into a puddle of oil over my shoe top, when I got laughed at by the pumper and Billy.

After we had dinner with the pumper, I looked things over carefully and found everything cool; the gland wasn't wabbling and the exhaust was good.

The pumper's oiling set consisted of a pail of crude oil from the wells and an old tin can for small work. The exhaust ran into a barrel near the door, and a pail of oil occasionally thrown into this and in a day or two skimmed off again, I was told, gave prime cylinder oil, and the cylinder looked fine.

"She's good for three years more now," Smith told the pumper as we started off, and maybe he was right.

W. Osborne.

High Efficiency of Steep Pitch Worms.

Editor American Machinist:

The articles by Mr. Halsey on "Modern Practice with Worm Gearing," which you published in 1898, were very interesting and instructive to me, and a recent experience with worms of different angles brought their lessons home to me very strikingly.

In building a special double-spindle lathe I wished to use a worm drive, and having a single-thread ¾-inch pitch hob, 2¾-inch outside diameter, I decided to work to that and made my gear with twenty-six teeth, giving a speed reduction of 26 to 1. The worm was to run at 460 revolutions per minute, but upon starting the machine I found it impossible to keep the worm and gear cool, and the belts could not pull the cut.

After comparing my results with the above mentioned articles I decided to make a new worm and hob having the same outside diameter as the one first tried, but with double thread and 2-inch pitch, and a new gear having forty-eight teeth, giving me a speed reduction of 24 to 1, or less than at first.

Upon starting the machine with the new

worm and gear, not only does it run perfectly cool, but the belts have ample power. We use graphite and oil on the worm, and it is not enclosed.

The angles of the two worms lie respectively below and above the danger line, ranging from 9° to 12° 30′, and the experience therefore agrees with Mr. Halsey's investigations, in which he found all worms having a smaller pitch angle than 9° to be failures, and all having an angle above 12½° to be successes.

Moline, Ill. WILSON P. HUNT.

[This letter is an addition to the constantly accumulating mass of evidence that steep pitch worm gearing is satisfactory, desirable and efficient.—Ed.]

A Holder for Chucking Drills.

Editor American Machinist:

The accompanying sketch shows a form of drill holder which I made for holding chucking drills. The object was to provide some means, independent of the lathe, for holding twist drills in a more positive manner than the usual taper shank with straight tang affords.

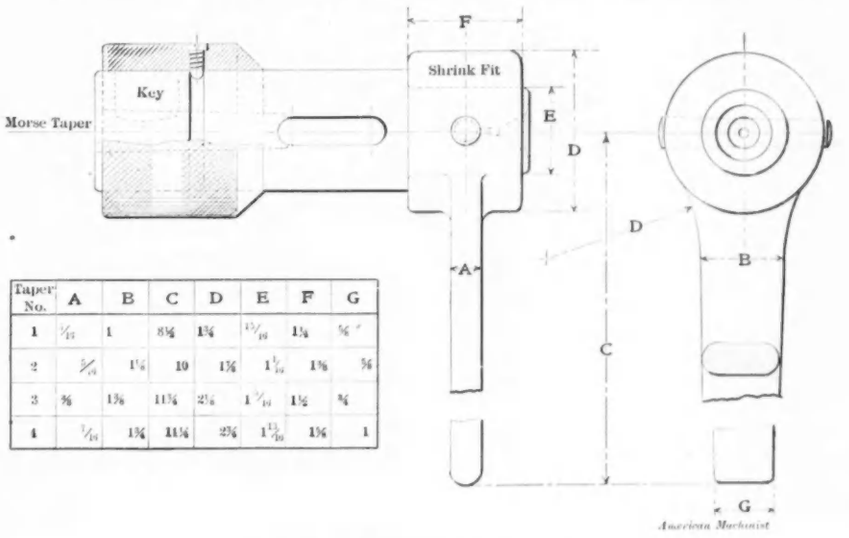
The "grip sockets" made by the Cleveland Twist Drill Company were procured, with rough shanks, and turned to dimensions shown in figures and table at *E* and *F*. A good-sized center, made after the manner of an arbor center and case-hardened, was provided at the rear end. A wrought-iron lever or handle was forged smooth to dimensions shown, and simply rubbed up with a file or emery wheel, the eye being bored a little smaller than *E* to make a shrink fit. The lever was then heated a cherry red all over and dropped in crude petroleum, which gave it a neat, black, finished appearance. After shrinking in place, a taper pin about ⅜ inch at large end, was driven through both lever and shank of holder to make a sure thing of it.

The flat drill has its place, and so also has the twist drill, my belief being that the latter would be used oftener and to better advantage in many cases were suitable means provided for holding. Something must be obtained that is strong enough to enable the user to get out of the drill all the business there is in it, and at the same time it must be convenient and universal. The holders at present on the market, driving entirely by the taper and tang, do not seem to be thoroughly satisfactory, although they are a move in the right direction. To fit the drill to the taper hole in the tailstock spindle, or even to a socket which in turn fits the tail spindle, does not seem to be the right thing to do when many lathes are used. The head and tail stock must be in perfect alignment or there is trouble immediately. Usually different tapers or different sizes of the same taper are present in any shop, thus making a multiplicity of sockets a necessity, and incidentally a thing to "try men's souls." Furthermore, it would seem that the ideal tool should enable *any* drill to be used in *any* lathe without special appliances for each one.

For some years it has been my practice to use a key or a driver of some sort in connection with taper shanks in all drillers and milling machines when possible. The "grave yard" in almost any shop in the shape of mutilated spindles and twisted shanks bears witness to the wisdom of this plan. It may be argued, and perhaps justly so in a measure, that this is the result of carelessness, but, nevertheless, the fact remains the same, for carelessness seems to be a besetting sin. Following this reasoning to its logical end has led to the making of this tool, which, after some months of the hardest kind of usage, seems to leave nothing to be desired.

The Cleveland socket was used simply because all the drills in the shop were milled on their shanks to fit the key of this style of socket, and it seemed to be a good thing where already used. I have found the socket very convenient to use. The knurled sleeve on the outside of socket has a cam slot over the key. A quarter turn brings the deepest part of the slot opposite key, so that key is free to rise, leaving the taper hole in the end clear. After inserting the drill, a quarter turn back again forces the key home, and the trick is done. Four screws in the knurled sleeve fitting a semi-circular groove prevent end motion. As has been stated, the device has been in practical operation for some months, and I am free to state that I would as soon return to the general use of the old-fashioned flat drill in a drill press as to be without it; albeit I still use the flat drill in both drill press and lathe for certain purposes. B. L. CHARLES.

[We cannot conscientiously allow this device to appear in our columns without a protest against the use of the conical center. No trick of the shop is more likely to lead to accident than the use of drills and reamers, and also of taps, upon the ordinary centers. The end of the holder should have a straight hole of good size and of considerable depth in it, and then there should be a pin center for the tailstock to fit it, and then if the drill should run ahead, as it is likely to do in finishing the hole, there would be no danger of anything getting caught and tearing things.—Ed.]



Taper No.	A	B	C	D	E	F	G
1	7/32	1	8⅝	1⅜	13/16	1¼	⅝
2	5/16	1⅛	10	1⅝	1 1/16	1⅜	⅝
3	⅜	1⅜	11¾	2⅛	1 5/16	1½	¾
4	7/16	1¾	11¾	2¾	1 13/16	1⅝	1

DRILL HOLDER FOR LATHE CHUCK WORK.

False Economy in Testing Machine Parts.

Editor American Machinist:

The wail of the man who complains in one of your recent issues about the boss suggesting a crude affair to serve as a drill jig reminds me of the unfortunate, as well as remarkable, fact that experienced practical executives will, as a rule, try to avoid the cost of tools for testing accuracy in parts finished ready for assembling.

Though it is positively necessary that such tests be made where accuracy and cheap cost as well as interchangeability are the results aimed at, it is nevertheless a fact that in most cases such testing fixtures are not provided until the same old story is again demonstrated, viz., that the machines gotten out are not accurate, that they cost too much in assembling, and that interchangeability is for the present lot not to be thought of. The contractor is again made aware of the fact that manufacturing fine machinery is not a snap, that the errors, whatever they may be, have cost him dearly. These unfortunate experiences are frequent indeed, and can be counted by hundreds. It would not take a mathematician wonderfully gifted to find that the moneys lost by this particular neglect aggregate vast amounts, and frequently compel the abandonment of good designs, simply because the coffers have been drained by a desire to complete the machines with least cost of tool making. As a rule, of course, blanking, bending and screw machine tools must be made.

but test fixtures are passed by; just why no one can tell, for everyone knows that for this class of work it is as necessary to use test jigs as it is necessary to use a pair of calipers on an ordinary turned job.

It is hard to tell just what effect this reminder will have upon those contemplating the manufacture of machines in which the aim is precision and possible interchangeability, but it behooves you to sound the alarm again, that those who read the "American Machinist," whether on this side of the great pond or the other, may know that if they desire good results, positive, accurate relative measurements, tests are absolutely necessary before assembling, and neglect of the same means positive failure that nothing will avert, and each machine must, if not so tested, be adjusted to its various parts and errors and made to work at a cost three or four times higher than first contemplated, and then the machines must lack the stability, as well as durability, and, of course, are far removed from interchangeability. The first lot is thus botched, and then comes the cry, "Where is the trouble?" Every skilled mechanic in the place will answer: "Parts should have been tested before putting together." Now, the super. knew this. He hasn't grown oil-soaked these many years without learning a thing or two; but he wanted to save by keeping down cost of tools. Well, he saved at the wrong end. The foregoing, Mr. Editor, is true. It is occurring every day; it is a true story of the sinking of thousands of dollars on both sides of the water. Again sound the alarm. Some hopeful mariner may be riding the waves and chasing rainbows in blissful ignorance. This may warn him of the breakers ahead, and he may take heed in time. In all probability he will not give the "American Machinist" credit for the awakening, but he will turn out better work, which is all you expect.

JOHN G. NIEDERER.

Repairing Engine Lathes.

Editor American Machinist:

I would like to say a few words about repairing engine lathes. I have read with interest the article by Theo. Leitz in your issue No. 20, which I think is all right; but he failed to show how the back bearing was bored in line with the front bearing. I once had a job of this kind to do on a 14-inch lathe, which needed not only a new live spindle and bearings, but a new tail spindle also. As this lathe was fitted with a spindle that did not extend clear through the back bearing, the thrust had to be taken up with the usual hollow screw. When this screw was properly set up it caused the hub of the driving gear to bear against the front bearing; this was all right until the spindle got slightly warm, and then it would get too tight to run easily.

I decided to make a change, and while I was repairing I thought it best to do the work as it should be done. We had several other lathes in the shop, so I had all the necessary new parts made and ready to fit, including new bearings and a boring rig to bore them in place. A pair of stands were cast, planed to fit the lathe bed and bored with a small boring bar carrying a sliding head (see Fig. 1). Care was taken to bore each stand in the same position on the lathe bed, as the dead center was lower than the live center. A bar was made to fit the stands, with a fine thread and a nut to do the feeding. The tailstock was bored first. The stands were then changed and the headstock bearings were bored (see Fig. 2). As only light cuts were taken the bar was easily turned with a small crank, while the feed nut could be held by hand. The spindle and thrust bearing were then fitted as shown in Fig. 3, in which *a* is a steel collar screwed on and completely covering the end of the spindle, *b* being a loose brass ring running idle between *a* and the end of the bearing brass. The front bearing was allowed to clear the collars on both faces. No more trouble has been given by these bearings, which need little attention, always running free and easy.

C. A. P.

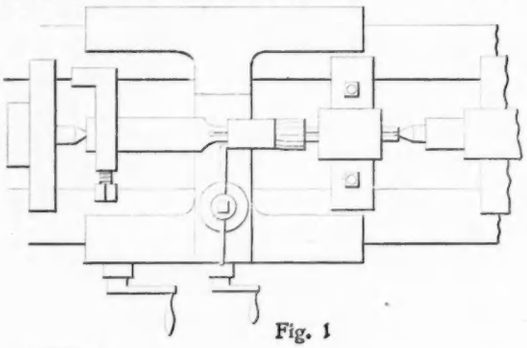


Fig. 1

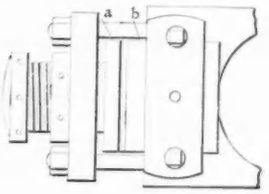


Fig. 2

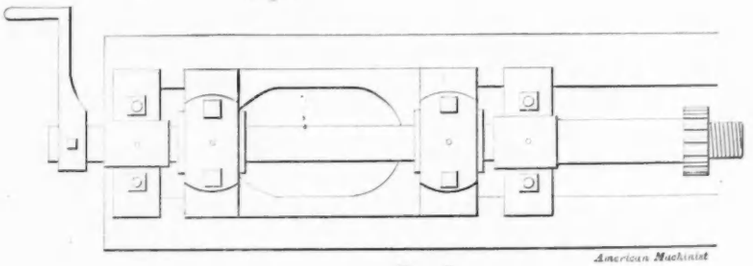


Fig. 3

REPAIRING A LATHE.

Repairing a Lubricator at Sea.

Editor American Machinist:

The lubricator illustrated in your issue No. 26 brings back to my memory what I considered at the time rather a neat little piece of all-round mechanical "know how."

I was, twelve years ago, second engineer of the British steamer "Ocampo." On board her we had just such a lubricator (called on the name-plate "Impermeator"), the only difference being that the nut for the square-thread feed-screw was the top of the ram itself.

We were outward bound from Antwerp for Buenos Ayres. On the fourth day out (with about thirty days at sea to follow) the thread in the ram stripped. The screw was square threaded, six to the inch. The engineers, excepting myself, were English, and there was always a lot of good-natured "kidding," on their part, of the "smart Yankee second" (all Americans are Yankees over there). "Why don't you fix it, Suverkrop?" they said. I turned to and got out the white-metal pot, bored out the top of the ram where the nut had been, ran in my babbitt, and made what looked like a nice bit of a job. But, unfortunately, I had not thought of the pressure on that screw. Half an hour after the nut was put in, the thread again stripped, and the poor "second" got more "kidding." This put me on my mettle. We had plenty of fireclay on board. I took out the screw, took two pieces of wood, dowelled them together with two dowels, heated the screw to a dull red and squeezed it in between the two pieces of wood held in the vise, at the same time rotating the screw. The result was a first-class core box. I next made a fireclay crucible, then a fireclay core with my wooden core box, and finally a fireclay mold, with my core secured in the center. The forge was then brought on deck and a fireman pressed into service to melt the *brass* this time in my fireclay crucible. When the casting was cold I had a nut with about four perfect threads and portions of threads to make about two more. Then followed filing and fitting to the ram, and that nut ran us out to Buenos Ayres (twenty-five days), up the river Plate (two months), and homeward bound (thirty-five days). On taking it out in Antwerp, there was no apparent wear on the nut.

E. A. SUVERKROP.

Philadelphia.

The Demand for Modern Machinery in the Philippines.*

ILOILO, ISLE DE PANAY, P. I., April 27, 1900.—Your correspondent recently accompanied a military expedition across the southern islands of the Philippine group, and was surprised to find that a very lively demand was springing up for steam power machinery, water wheels, wood-working apparatus, metal machinery, sewing machines, typewriters, bicycles and machinery for handling the great products of the islands in the woods and the sugar and tobacco crops. Your readers may be interested in knowing something about this demand and how to meet it. First of all, American machinery is preferred by the old-time sugar-mill owner of the Philippines, and his example is usually followed by the others, for the reason that the sugar-mill men not only control nearly all of the vast industrial interests of the islands, but they are the ones who have the money, own the lands and the forests, and many of them are the residents of the cities, towns, or barrios. The sugar-mill men are all Filipinos, Spanish or Chinese, and all are very rich, for the sugar mills have paid enormously here for many years. During the past few months there have been Americans prospecting with a view of securing control of many of the sugar mills, fitting them out with steam or water-power machinery, modern devices and improved methods. Americans have also looked about to see what can be done concerning the controlling of the vast forests of woods and working them with modern machinery. There are immense forests of the most excellent hard woods here, which are simply chopped into firewood or used for making the most inferior or commonplace articles. The native carpenters think nothing of using a nice board of mahogany for the side of a pen for caribou or pigs. The rich red woods and black walnuts are chopped for firewood, and are used for building purposes as if the stuff were cheap pine. There is no pine here, and only the hard woods can be used for building and constructive purposes.

As fast as the American troops have advanced in the interior on the islands of Luzon, Panay, Cebu and Negros, new territory has been opened into which Americans have poured with goods for opening stores and machinery for starting sugar plants, wood-working machinery, printing presses, and the like. The result is that there is a great demand for motive power machinery. It seems that many of the enterprising persons who came to these islands with a view of beginning the manufacture of some product relied upon the water powers to a considerable extent. It was supposed that the rivers could be dammed and the proper head of water secured to run a turbine. But there is a dry season here from November to June, when the rains cease to fall, the earth becomes baked and cracked with dryness and heat, and the rivers run almost dry because no rains fall. During this time the waterwheels would be at a standstill. On the other hand, in the middle of the rainy season the rains fall so heavily that the rivers are overflowed and the earth becomes a miry, spongy mass. During this period there would be back water much of the time, thus putting the waterwheel out of service. The surest way to get a steady power in these islands is by using steam boiler and engine. The natives use the caribou for turning walking beams, but this is slow and unsatisfactory.

As soon as an improvement is put in at one place others want the same. I have seen an engine put into a sugar mill, and every day thereafter some native sugar-mill proprietor comes in from a distance to examine the outfit, and in nearly every case he either tries to purchase the plant for his own use or learns how he can get one like it. I have seen a plant which cost $2,000 in the United States, and about $300 to get it here, sold for $10,000 to a rich sugar-mill owner, who paid the cash down. These mill owners do not hesitate to pay out money for improvements now that they know that their property will have the protection of the American troops. Formerly the Spanish soldiers looted as well as the bandits of the islands, so that between the Spanish and the mountain guerrillas the sugar-mill owner had little chance to hold on to his property. No one bothered his crude outfit of turn beam and rolls operated by animal power, but if he possessed an engine he would have no peace until all the brass work and small parts had been stolen. In fact, he could not keep any of his plant complete.

One only has to cross these islands of the Philippines to observe the remarkable advancement which is going on in every line of industry. In the days of Spanish rule, if a man put up a building for industrial purposes, the Spanish officials would claim duties, the Spanish soldiers would confiscate property, and the ladrones would steal the products, so that the native owner would soon go out of business. If he starts an industrial enterprise of any description now he is assured of protection for himself and property. The result of this change is noticed in all of the islands of the group. Native and foreign capitalists are putting in modern sugar working machinery, harvesting and cultivating machinery, apparatus for handling the great wood products of the islands, mining devices, wood and metal working machinery of all sorts. Not only are machines of all types wanted here, but very good prices are obtained, and sales agents for machinery houses are doing a very profitable business.

The agents who are making the most out of the situation are those who brought samples of the machines with them, with a man to set up the machinery and operate it in a place where it can be inspected by the prospective purchasers. The natives have been fooled by the Spanish for so many years in this buying of machinery that they are chary. I recollect seeing one Spanish machine which was sold at a very high price to a native machinist, and which was supposed to be modern, which bore the stamped date 1844 and was worthless, owing to the absence of certain parts which could not be duplicated. The machine was painted up in fine style and appeared to be new. This machine could never be made to work. There are numerous instances of the kind. Spain had a habit of using the Philippines for a dumping ground for rejected machinery. Spain would ship only old hand presses here, and the only paper of the Isle of Panay was printed on a Franklin hand press, with lever, as late as last December in Iloilo. The same printers now have American types of presses, and are making a very large amount of money by running a job office in connection with their little daily sheet. Formerly the proprietors had difficulty in earning enough money to pay expenses. They now do the printing for the business houses of about 20 cities, 100 towns and some hundreds of barrios on this Isle of Panay. There are no printing establishments on the Isle of Mindanao, Cebu or Negros, and the firms there requiring bill heads, etc., have to send to Iloilo or Manila. Some send as far as the United States to get printing done. Most of the presses are operated by foot power, but in Iloilo they have put in an engine, and in time there is going to be a good call for engines and boilers for this service.

It is very advisable for agents of steam goods houses, printing presses, typewriters, etc., to be furnished with small working models of all machinery represented by them. I noticed that one agent of an electric road concern from America was here with plans and specifications for the putting in of an electric road to connect the cities and towns of the islands. The whole thing was planned out in magnificent shape and was thoroughly correct. But he could hardly get a native interested. On the other hand, a party who was here for the same purpose, and represented another firm, had with him a complete little working model of a power house, tracks and cars, and arranged to put his apparatus in operation on the floor of a large room. This room was always crowded with the wealthy natives of the islands, who invested their money in the stocks very liberally. The man with the same thing on paper could not sell any stock, while the man with the working model had only to show his little mechanical device and the rich native would invest. The same idea prevails concerning all machinery offered for sale here. There should be complete working models of flour mills, printing outfits, typewriters, etc.

If a representative of a sewing machine

* From "The Iron Age."

company could arrive here now or within three months of now with a shipload of good grades of sewing machines he could sell them all on the wharf at advanced prices and make a great deal of money. When Spain was in charge of the islands her one idea seemed to have been to abstract money from the people. If the people wore clothes, this meant so much money less for Spain to draw from, as clothes cost money. So Spain encouraged the natives to go without much clothing. But the Americans have no such ideas, and about the first order the United States officers of the troops issued was for the male natives in breech cloth to get into white duck suits. This order was carried out, and the result was that every sewing machine on the islands was set to humming night and day to make new white duck suits for the millions of natives who had thus suddenly been ordered into clothes. The crudest sorts of worn out old sewing machines were bought and sold for about ten times their first price, for all the native and other tailors wanted machines so as to meet the new demand for white clothes. Many machines came in from other countries soon after, as ambitious agents and tailors cabled for some. I saw some of these machines, and many of them were the rejects of other countries and suitable for the junk pile. One tailor showed me with glee a nice little sewing machine he had bought for about $75, gold, and which upon looking at I saw was one of the first kinds of sewing machines to be introduced, and operated by a hand crank. He now works it by running the cranked portion with belt and wheel from an overhead shaft, as he uses power in his shop.

The average native is a sort of mechanical genius, and he can quickly be taught to run engines and care for machinery. Native labor is so much cheaper than American that many American manufacturers employ natives for firing, engineering work and mechanical work about a plant, for they work for about 25 cents per day and care for themselves. There have already been some oil and gas engines put in for use in running small power establishments, and these machines are cared for by native attendants, who do the work well after a little instruction. There has been no one here as yet to represent oil or gas engine concerns, and what engines of this type have been put in here have been ordered singly by individuals. If there were a regular agency established in Manila, Iloilo, Cebu and on the Isle of Mindanao, a large business would result. I have personally interviewed many small manufacturers of combs from caribou horn, workers in metals of the islands, etc., who want small power-producing devices, and who would order at sight and pay well.

The recent advancement in all things pertaining to the native, his mode of living and his method of working has brought about some remarkable changes in the brief space of eight months. Eight months ago the rebel army occupied positions near all of our strongholds in seaport towns, and everything concerned was riot and confusion. As soon as the Americans broke into these insurgent armies and sent them to the hills, there to disband practically, the thoughts of the native have run in other channels. Instead of fighting he now wants things peaceful and modern, and the Americans are teaching him some very good lessons. Probably there are 100 typewriting machines in the islands of the Philippine group. In Iloilo there are ten machines, and these machines are the wonder of the rich natives and the business men. Anyone having a $100 typewriter here can sell it for $250 any day. There are some thousands of rich native families on the Isle of Panay alone, and they do not hesitate to purchase the modern things as fast as they know of their existence and use. The typewriting machine in the possession of your correspondent has seen service in America for several years, yet would bring $250, gold, any time. There are no typewriter agencies in any of the islands, except at Manila, where there are two, recently established, but these do not do the natives of the other islands any good, for the native will not buy a machine on the strength of its advertisements, no matter how plainly it may be illustrated. This is because Spanish dealers in machinery fooled him so much in the past. The Spanish agents would get the money in advance on the strength of nicely colored plates printed of the machines on paper, and would then send the natives some worn-out, old, broken-down, out-of-date machines.

There are very few bicycles in use in the islands of the Philippine group, but there is room for many. The natives will buy bicycles if given a chance. They now crowd about a rider and want to see all parts of the wheel, try it, and usually finish by offering the owner about five times the value of the machine to part with it, which he usually does not do. Since the American authorities have commenced using captured native ladrones and bandits from the mountains for work on the streets and roads, the latter have become quite suitable for wheeling. A year ago a bicycle could not have been used except on the streets in and about the larger seaport cities, but it is practicable to go almost anywhere on a wheel at present, especially in the dry season. There are two or three wheel agencies in Manila, and one agency in Iloilo, the latter having just opened, and the agent has sold no wheels, for the reason that he made the mistake of bringing with him only pictures of the wheels, intending to sell upon the strength of these, taking payment in advance and having the wheel reach the purchaser in about three months after the deal is made. Had he brought about 1,000 wheels with him, he could have sold them all the next day at prices averaging double the American value.

There is not a windmill in use in the islands of the Philippines, and probably there is no country in which windmills are needed so much as here, and no place, certainly, where the mills could be worked under such favorable circumstances, for the islands are all so situated that there is a sea breeze across them at all times, and of sufficient force to maintain the evolutions of the ordinary windmill. The mills are needed here to pump up water. In every city and town of importance about 100 natives are required to laboriously pump up water to the proper elevation for tanks and other purposes for needs of city uses. In some of the cities they now have the streets watered, and the water all has to be raised by hand pumps to an overhead tank from which to fill the water carts. Water for drinking purposes in even the small barrios is all pumped up by hand and drawn from as required by the people. Windmills could do this work better and cheaper. But the natives do not know what a windmill is. They have never seen one, and although the writer has spoken with the managers of the towns, these natives do not know what is meant. They are, however, very willing to purchase the required outfit of wind-power machinery for water-raising purposes in any of the communities. There is a call for the best grades of mills and worn-out machines ought not to be sent here. Very good values can be obtained, and the parties providing the windmills can afford to ship in the best designs of modern mills.

G. D. R.

Legal Notes—Where Employer is not Liable to Servant for Fellow Servant's Negligence—Case Where Liable.

BY WM. MARSTON SEABURY.

"Joe" Chamberlain's suit against his employer, Stevens, was recently decided by the United States Circuit Court of Appeals, First Circuit. Chamberlain was employed as a spare fireman in Stevens' Woolen Mills, and was also supposed to act as night watchman, to wheel the ashes out of the boiler room and to do the chores at the superintendent's house.

In the mill was a heavy press for pressing rolls of cloth. It was bedded in a pit in the floor of the mill, the bottom of which pit was dark and slippery, with oil oozing down from the press.

A portion of this machine consisted of a heavy iron plate supported by two large press screws. These screws required repairs. One Streeter, who was the master mechanic for the mill, requested Chamberlain to assist him in repairing the press, and while they were so engaged, the heavy plate fell and injured Chamberlain.

The jury in the trial, which was had

in the United States Circuit Court for the District of New Hampshire, brought in a verdict for Chamberlain, the plaintiff. Judgment was entered, and the defendant appealed upon the ground that the judge before whom the case was tried refused to direct a verdict for the defendant.

The Appellate Court reversed the judgment of the trial court, set aside the verdict of the jury and remanded the case to the lower court for further proceedings.

The Appellate Court came to the conclusion that Streeter, through whose negligence the plaintiff received his injuries, was a fellow servant of Chamberlain, and that Stevens, the employer of both, was not liable for the injury complained of. After considering this subject, the court said: "Under these circumstances, the request to the court below to instruct the jury to return a verdict for the defendant . . . should have been granted. We may add that there is no rule of natural justice which holds an employer who is personally without fault, liable in damages for the faults of others." (100 F. R. 378.)

WHAT AN EMPLOYEE MAY ASSUME AS TO A FELLOW SERVANT.

The case of Olsen against North Pacific Lumber Company was recently decided by the United States Circuit Court of Appeals, Ninth Circuit.

Olsen was in the employ of the North Pacific Lumber Company and was engaged to work in the defendant's sawmill in Portland, Ore., as "second off bearer," with one Riley Rearick as sawyer. It was the duty of Rearick to operate the machinery which moved the derrick; and of the off bearer, to handle the hooks attached to the derrick, place them upon the cant or logs, when about to be conveyed to the pony carriage, and remove them when the cant was in position on the carriage. The controversy between the parties hinges partly upon what notice should have been given by Rearick and what care should have been used by him in the performance of his duties. The plaintiff contended that Rearick should not have started the machinery until he was away from the carriage, and that in spite of the fact that Rearick and the plaintiff, Olsen, were fellow servants, the defendant was nevertheless liable to Olsen for injuries received through the incompetency of Rearick, of which incompetence the defendant had knowledge. There was conflicting testimony as to the reputation of Rearick for carelessness, and it was not shown that either the plaintiff or the defendant had any actual knowledge of his carelessness.

Rearick testified, however, that when Olsen was hurt he went up to him and asked him how bad he was hurt, and that Olsen replied, "You careless ——, I knowed you would do it." Upon the trial court's charging the jury, they brought in a verdict for the defendant, and the plaintiff appealed upon errors committed by the trial judge in charging the jury. Among other things, the trial judge had instructed the jury that "if the plaintiff had the same notice that the defendant had, the defendant having notice (of Rearick's carelessness), then he would himself be negligent in going on and accepting the employment." In reversing the judgment of the trial court, the Appellate Court said: "The law did not charge the same duty on the plaintiff in regard to Rearick as it did on the defendant. . . . It is a master's duty to employ careful servants. One accepting employment may assume that such duty has been performed in the selection of his fellow servants. This is the established rule, and manifestly it could not be if a servant is chargeable with the same obligation of inquiry as a master, and from a constructive knowledge deemed to assume the risk of the master's neglect." (100 F. R. 384.)

Manufacturers.

The Camden (N. J.) White Lead Works are to be extended.

The erection of the $250,000 steel plant in Parkersburg, W. Va., will proceed.

A foundation for an electric light plant at Royalton, Vt., has been begun by O. N. Stoughton.

The Fayette Oil Works, Fayette, Miss., have just received bids for the construction of new buildings.

The cornerstone has been laid for a plant of the Newaygo Portland Cement Company, at Newaygo, Mich.

The Long Island Railroad Company, it is rumored, proposes to erect a large machine shop at Sag Harbor, L. I.

A large cottonseed oil mill is being erected at the Plant depot, just opposite the guano factory at Birmingham, Ala.

The American Mills Company, manufacturer of woolens, is building a large addition to its mill at Rockville, Conn.

The sawmill of the Black Mountain Town & Improvement Company, ten miles south of Guffey, Colo., has been burned.

It is reported in Benwood, W. Va., that the Wheeling Steel & Iron Company has begun the erection of a new tube mill.

Ground was broken July 9 for an addition to mill No. 4 of the American Thread Company's plant in Willimantic, Conn.

In a fire at its cellulose plant at Owensboro, Ky., the Marsden Company, of Philadelphia, Pa., lost $5,000 worth of machinery.

The Sandusky, O., factory of the Standard Wheel Company, Terre Haute, Ind., was recently destroyed by fire. It will be rebuilt.

That a 50-ton mill will be built this year by the Ely Mining & Milling Company, at the Ely (Nev.) mines, is said to be practically assured.

Ground has been broken at Lockport, N. Y., for a new glass factory on Michigan street, between Niagara and the New York Central tracks.

J. Dornette & Bro., Cincinnati, Ohio, manufacturers of desks, have nearly completed a four-story extension containing 30,000 square feet of space.

New shops for the Burlington railroad are to be constructed at Hannibal, Mo. James McGonigle, of Leavenworth, Kan., has the building contract.

The contract for rebuilding the flour mill of Martin & Warnock, of Ottawa, Ont., on

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Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Dies & punches. Amer. Hdw. Co., Ottawa, Ill.

Gear Wheels, gear cutting. Grant; see p. 22.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa., build light machinery.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Wanted—Parties with facilities to manufacture medium and heavy high-grade machinery. Address "Phila.," care AM. MACH.

Good, practical machinist wanted to run machine shop of his own in central part of Wisconsin; must have $3,000 capital; good business and location. Box 175, AM. MACH.

Gear and Milling cutters, adjustable reamers and special tools; vertical millers, cutter and surface grinder and shears. Catalog of small tools free. R. M. Clough, Tolland, Conn.

For packing rings that make a piston valve steam tight and nearly frictionless, that do not wear narrower, their groove wider, nor the seat larger at the port than elsewhere, write J. H. Dunbar, Youngstown, Ohio.

Wanted—Young and experienced engineer and superintendent seeks an opportunity of purchasing an interest in a foundry, machine or boiler business, where he may engage actively in same. Box 168, AMER. MACHINIST.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

A well-equipped machine shop and foundry, with ample water power, capacity 50 mechanics, tools suitable for engine building up to 24 x 24-inch or similar work, invites proposals in their line, or will consider manufacturing new specialties. Address P. O. Drawer 414, Lockport, N. Y.

A well-known steam engineer and designer of unquestionable ability and push desires to enter, as partner, an established engineering business or fair-size machine shop located at or near Chicago; the writer is a resident of this city for 20 years, and consequently well acquainted in business circles. Parties looking for an opportunity like this will please write to Box 167, AMERICAN MACHINIST.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Draftsman, technical graduate, experienced on mill and special machinery. Box 171, A. M.

Experienced machinist and draftsman wants place; age 25; can handle men. Box 165, AMERICAN MACHINIST.

Chance to improve as diemaker; 3 years machinist, 2 at toolmaking; age 22; rate, 22½c. an hour. Box 170, AMER. MACHINIST.

Man well qualified to design tools and fixtures for manufacturing, or as foreman toolmaker, wants to change; would teach. Box 172, AMERICAN MACHINIST.

Wanted—Position to superintend erection and sell machinery, with some experience; am also a competent draftsman; best of references. Box 169, AMER. MACHINIST.

Experienced designer and shop manager on steam and gas engines, also special and automatic machinery, desires position; New York or vicinity. "X.," AMERICAN MACHINIST.

Wanted—By man, 28, a position which is not confining, to make profitable use of several years' mechanical experience; has ability as salesman. Box 146, AMER. MACHINIST.

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(*Continued from page* 47.)

the Richmond road has been awarded to Mr. R. Cowie, who has commenced work.

The Thistlewaite Drill Manufactory, which has been perfecting an improved grain drill while temporarily operating in Fairport, N. Y., will shortly remove to Despatch, N. Y.

Ex-Senator J. N. Hooker, of Bartow, Fla., has just sold to Boston parties 570 acres of fine phosphate lands. A large phosphate plant will be erected on the property at an early day.

It is reported at Detroit, Mich., that San Francisco capitalists, represented by W. F. Ayres, propose to erect a factory for the manufacture of automobiles at Bay City, Mich.

The Elkton Foundry Company, of Elkton, Md., is contemplating the erection of a new foundry. Interested in the company are Dr. Charles M. Ellis, Geo. McQuilken and J. F. Power.

Simon Edlavitch, a merchant of Bladensburg, Prince George's County, Md., is to erect a flour and meal mill of some 525 bushels daily capacity, having a two-story boiler and engine-house.

Bids have been received by the officers of the Indianapolis, Martinsville & Southern Railway for a dam in White River, near Waverly, Ind., and the foundations for the power-house of the line.

It is reported that Mr. A. H. Overman has leased the Ames Building, in Chicago, Ill., for the purpose of manufacturing automobiles, and that the work will be done by the Overman Automobile Company, with a capital of $250,000.

The A. B. See Manufacturing Company, maker of elevators and electric motors, announces the removal of its office from the works in Brooklyn to the St. Paul Building, No. 220 Broadway, New York. Telephone number, 5133 Cortlandt.

The Quintette Manufacturing Company, Eatonton, Ga., has applied for charter, and it is understood that they will erect a cotton mill. The Putnam County Manufacturing Company there has been reorganized with the purpose of building a yarn mill.

The Columbia Fire Cracker Company, of Bucyrus and Fostoria, O., has had rough plans outlined for a new factory, comprising a main building, 150x80 feet, and six or eight other good-sized ones, and to be equipped with new and improved machinery.

The Racine Iron & Steel Company has been incorporated by G. N. Prentiss, John B. Benson and Frank M. Taylor in connection with the J. I. Case Threshing Machine Company, Racine, Wis. The new company will erect a large plant for the manufacture of boilers.

The Union Manufacturing Company, maker of chucks, New Britain, Conn., has had plans prepared by Architect W. E. Griggs, of Waterbury, for a new factory to be built on Church street. It will be one-story, brick structure, 38x90 feet, with asphalt roof and copper ventilators.

The E. B. Eddy Company, manufacturers of matches, pulp and paper, of Hull, Quebec, whose works were destroyed by fire, have started to rebuild their numerous factories. This concern has ordered machinery in this country already to the extent of $150,000 or $200,000.

John Ballantyne & Sons, manufacturers of hosiery, contemplate adding a three-story addition, about 30x60 feet, to their plant, 283 Ashmead street, Germantown, Pa. They have just closed a contract with the E. Keeler Company, of Williamsport, Pa., to put in a boiler and stack.

The Linton Milling Company, Linton, Ind.,

(*Continued on page* 49.)

Situations Wanted—Cont'd.

Position wanted as head foreman by thorough mechanic, used to general machinery, dynamos, tools; tools designed for interchangeable work. Address Box 163, AM. M.

Technical graduate (23) desires permanent position which would require energetic hustler; draftsman or equivalent; references and experience. Address "Original," AM. M.

Superintendent of large screw and bolt works desires to change; mechanical engineer; 12 years in charge of bicycle, electrical machinery and machine-tool plants. Box 177, AMERICAN MACHINIST.

A thorough, up-to-date machinist of practical inventive ability, well experienced, good draftsman, systematic, used to take charge, wants suitable position to make full use of his ability. Box 164, AMERICAN MACHINIST.

Superintendent—Position wanted, by an experienced designer, die and tool maker; up-to-date foundry and machine-shop practice and general manufacturing; care and training of help; economical; highest reference; 36; sober; steady. J. M. R., AMER. MACHINIST.

Position as superintendent or general manager of machine works desired by practical man now holding responsible position; fully understands handling help and can furnish highest references; New York or vicinity preferred. Address Box 166, AMER. MACHINIST.

Position as traveling salesman; 15 years' experience; 6 years with present concern; would fit into any mechanical line; accustomed to closing large contracts; can earn salary or quit; salary $3,000 and expenses; can sell anything that's good; don't want to sell anything else. Box 120, AMER. MACH.

Toolmaker and machinist of ability and long experience wishes position, preferably as foreman or superintendent; expert on labor-saving tools and up-to-the-minute methods of doing things; good draftsman; accustomed to handling men on first-class work so as to get quick results at small cost. Box 155, AMERICAN MACHINIST.

Foreman—Two expert mechanics; one on small, accurate tools, dies, special machinery and fixtures; the other on machine tools and the interchangeable system of manufacture; both holding responsible positions; as foreman and superintendent, respectively, where experience, ability and new ideas will be appreciated; New York or vicinity preferred. Box 178, AMERICAN MACHINIST.

Help Wanted.

Machinists wanted; good wages and steady work. Apply De La Vergne Ref'g Machine Co., foot E. 138th st., New York.

Draftsmen desiring extra money, state where employed, confidential. Edwin Guthrie, Corcoran Building, Washington, D. C.

Machinist wanted, to run large Niles milling machine. Apply to The De La Vergne Ref'g Mach. Co., foot E. 138th st., New York.

Machinist contractor wanted to handle about 75 men; one acquainted with steam, oil and gas engines preferred. T. M. D., AMERICAN MACHINIST.

Wanted—Pattern maker; a young man, quick and apt, with 1 or 2 years' experience in general pattern shop preferred. Address Soule Steam Feed Works, Meridian, Miss.

Foundry foreman; one who can take charge of 150 men and produce results; state experience, salary wanted and age. Address "Ohio," care AMERICAN MACHINIST.

Expert layer-out for boiler shop; one accustomed to laying out intricate work from blueprints. Address, giving age, experience and salary expected, L. O., care AM. MACH.

Wanted—An instructor in mechanical engineering; shop and drawing-room experience, also diploma from technical school, required. Address, stating qualifications, age, etc., Box 153, AMERICAN MACHINIST.

Wanted, Immediately—12 first-class toolmakers; none but those accustomed to fine work need apply; also 12 first-class, all-around machinists. Address Driggs-Seabury Gun & Ammunition Co., Derby, Conn.

Wanted—Man to take charge of die department, who is experienced in handling men and in the construction of sheet metal working dies, by a concern in large town in western New York. Address "Folsom," care AM. M.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—Tool-room hand for a moderate size machine works in western New York; one familiar with milling machine and gear cutter; steady position to right man. Address, with particulars and reference, Box 174, AMERICAN MACHINIST.

Wanted—A first-class mechanic as foreman; must have thorough knowledge of gear cutting in all its branches and be able to get out work rapidly and economically; this is a permanent position at good wages for the right man. Address Box 152, AMER. MACH.

Foreman boiler maker, by a shop employing about 150 men; man must have complete knowledge of all details, and be able to handle men to good advantage; good salary to right man. Give age, reference and salary expected to F. B. M., care AMER. MACHINIST.

We can use on heavy boring machines, planers and large lathes several first-class machinists who can and will make these machines do all they were designed to do; unless you can earn 30 or more cents per hour do not apply. Gates Iron Works, 650 Elston ave., Chicago.

Foundry Foreman—Iron and brass foundry department of New England concern manufacturing engines and machinery requiring first-class castings; founury employs 30 to 40 men; large town, attractively located; give experience, references and pay expected. Box 173, AMERICAN MACHINIST.

Assistant to superintendent wanted; applicant must be between the ages of 35 and 45; technical education; experienced in manufacture of general, automatic and labor-saving tools; replies must contain experience, salary wanted and references. Address "Manufacturer," Box 162, Hartford, Conn.

We have an opening for several bright young men, operating special wet grinding machines; should have some knowledge of machinery, but not necessarily machinists; pay of journeymen machinists after proficiency is attained; location in small country N. E. town; state experience. Box 161, AMERICAN MACHINIST.

Wanted—By a manufacturing company, in their general offices, New York City, a mechanical engineer (technical graduate preferred) as salesman and assistant to manager; should have had shop experience, or as machinery salesman. Address, stating age, references, past experience and compensation expected, "Graduate," care AMER. MACHINIST.

Wanted—Foreman for toolroom in machine shop located in Western Pennsylvania, employing 125 men on high-grade gas and steam engine work; must be capable of designing jigs and tools for economical, rapid and accurate work, where all parts are made interchangeable; state age, experience and salary desired; references required. Address "Improvement," care AMERICAN MACHINIST.

A well-established machine-tool shop, located on the Rhine, Germany, desires the services of a first-class, experienced constructing engineer; one familiar with the designing and construction of hydraulic machinery adapted to shipbuilding; position permanent to the right man; one conversant with the German language preferred. State salary and references, addressing "Engineer," care David Williams Co., 5th & Main sts., Cincinnati, O.

We're Looking For Work.

Want to build special machinery and to do other light or medium heavy work, and don't expect to make all our profit on one job. Let us know what you want and we'll make you a proposition that ought to bring the work our way.

F. J. STOKES MACHINE CO.,
Thirteenth and Noble Sts., Philadelphia, Pa.

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